

EDUCATION AND NATIONAL DEVELOPMENT

शिक्षा और राष्ट्रीय विकास

शिक्षा आयोग का प्रतिवेदन - 1964-66

REPORT OF THE EDUCATION COMMISSION 1964-66

NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

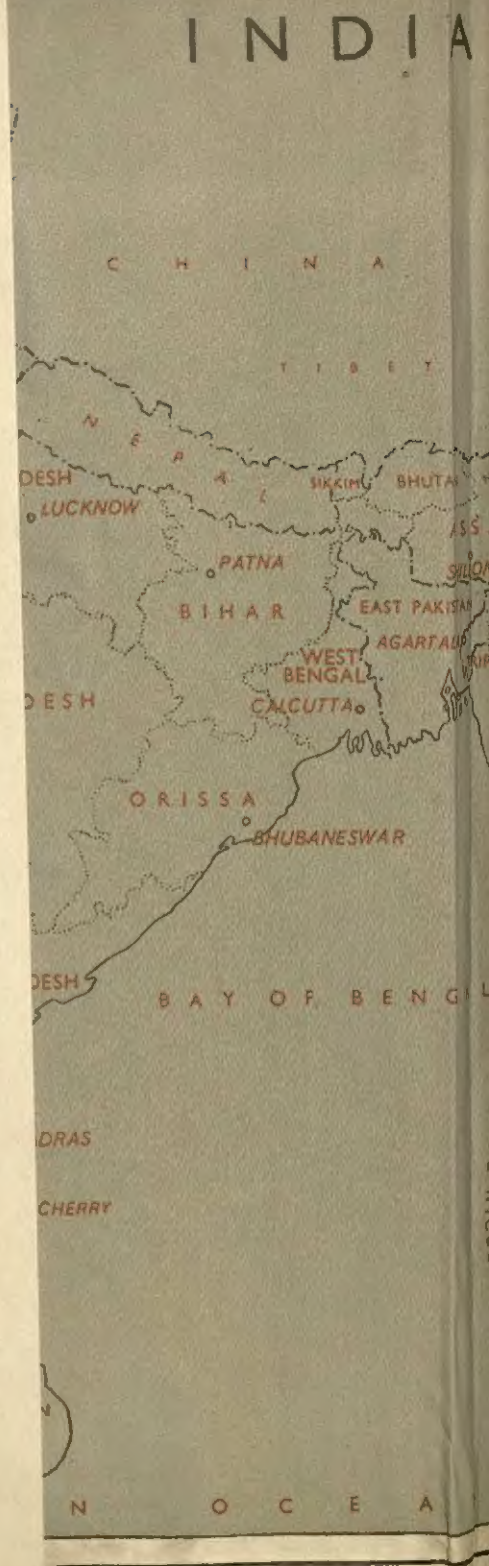
THIS reprint edition of the Report of the Education Commission (1964-66) is being brought out in four volumes for ease and convenience of handling and to provide readers interested only in a particular stage or sector of education with the relevant sections of the Report.

All the four volumes carry a new, exhaustive subject index covering the entire Report. This index will enable the reader of each volume to locate even the most detailed reference and to make inter-volume cross-references.

All the charts and graphs in the Report have been re-done and made more intelligible. The data in the chart showing educational levels of manpower in various occupations, which appears as the frontispiece, have been shown in detail in four component charts, printed in five colours. Each of the four volumes carries these colour charts and the complete index.

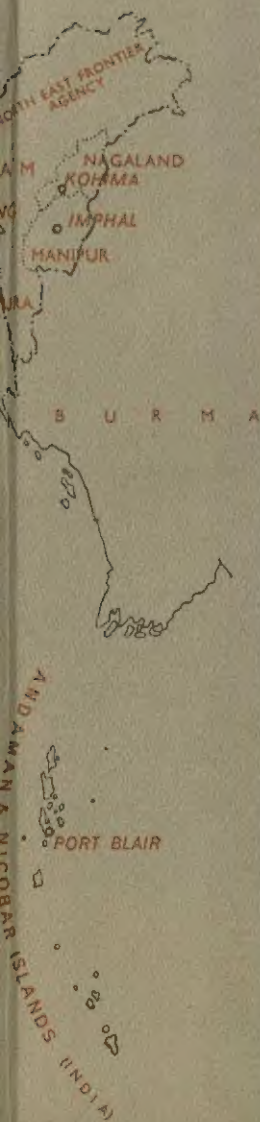
The Resolution outlining the National Policy on Education, issued by the Government of India on the Report of the Education Commission is reproduced in each volume for ready reference.

(Continued on the back flap)



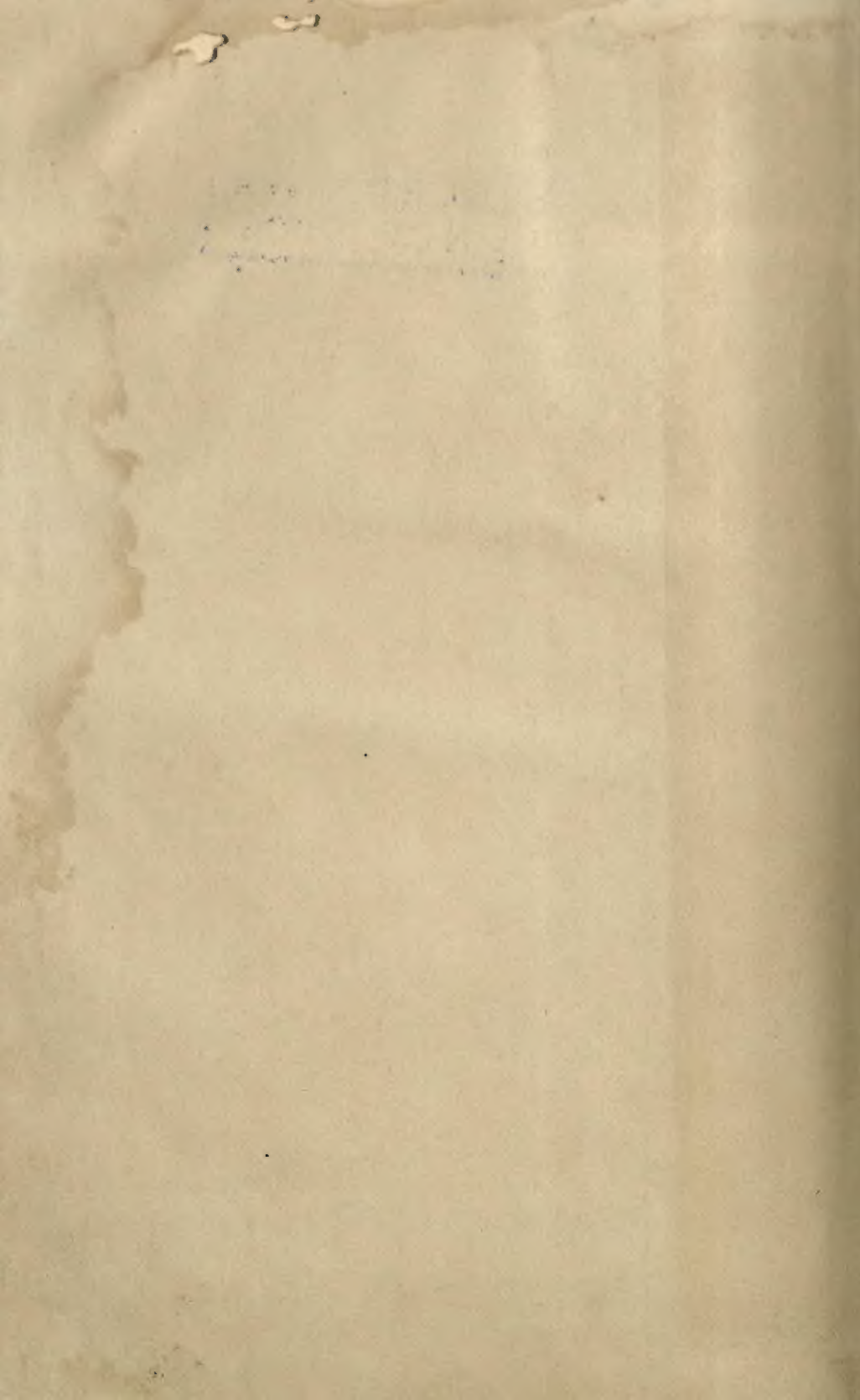
1966

S.C.E.R.T., W.B.
N.C.F, '2006



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EDUCATION
AND
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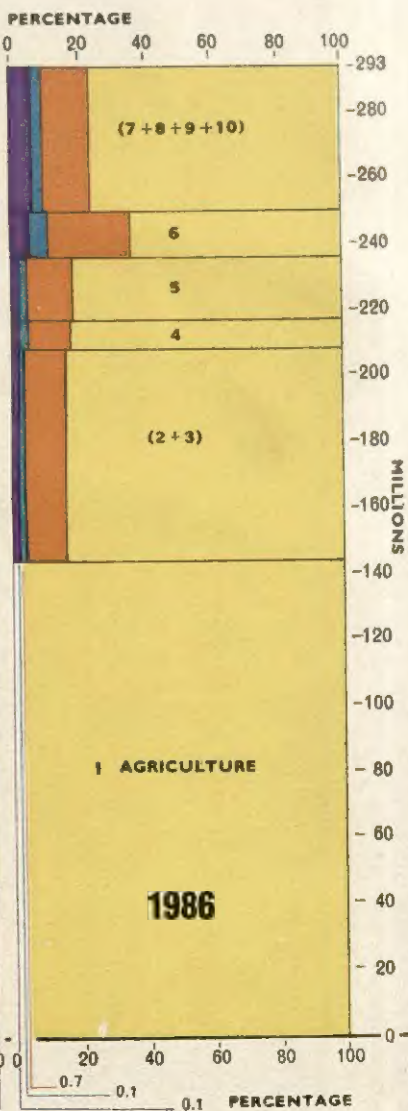
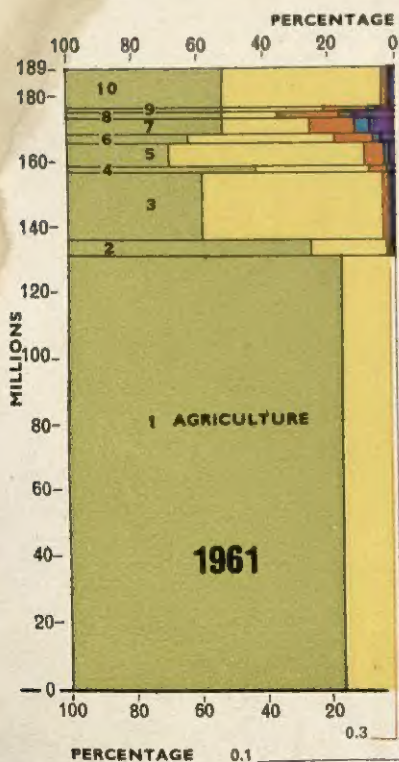
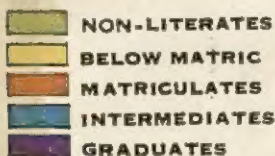
REPORT OF THE EDUCATION COMMISSION

1964-66

EDUCATIONAL LEVEL OF WORKING POPULATION (INDIA)

1961 (actual) & 1986 (proposed by Education Commission)

- 1 AGRICULTURE
- 2 MINING
- 3 MANUFACTURING
- 4 CONSTRUCTION
- 5 TRADE & COMMERCE
- 6 TRANSPORT & COMMUNICATIONS
- 7 PUBLIC SERVICES
- 8 EDUCATIONAL SERVICES
- 9 MEDICAL & HEALTH SERVICES
- 10 OTHER SERVICES



VOL 3: HIGHER EDUCATION

EDUCATION
AND
NATIONAL DEVELOPMENT

REPORT OF THE
EDUCATION COMMISSION 1964-66



NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

1970

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New Delhi
29 June 1966
Asadha 8, 1888

Dear Shri Chagla,

I have much pleasure in submitting the Report of the Education Commission.

I would like to take this occasion to express to you my own and my colleagues' sincere gratitude for the support and encouragement you have always so generously extended to us in our work. The appointment of the Commission is largely due to your initiative and vision.

Education has always been important but perhaps never more so in man's history than today. In a science-based world, education and research are crucial to the entire developmental process of a country, its welfare, progress and security. It is characteristic of a world permeated by science that in some essential ways the future shape of things is unpredictable. This emphasizes all the more the need for an educational policy which contains a built-in flexibility so that it can adjust to changing circumstances. It underscores the importance of experimentation and innovation. If I may say so, the single most important thing needed now is to get out of the rigidity of the present system. In the rapidly changing world of today, one thing is certain: yesterday's educational system will not meet today's, and even less so, the need of tomorrow.

It is difficult, and it is certainly so for us, to say to what extent the Report will actually help in the reconstruction of the educational system which is so urgently necessary. We trust, however, that the Report will provide some basic thinking and framework for taking at least the first step towards bringing about what may be called an educational revolution in the country. The Report makes recommendations about various sectors and aspects of education. The main points that immediately come to my mind are:

Introduction of work-experience (which includes manual work, production experience, etc.) and social service as integral parts of general education at more or less all levels of education;

Stress on moral education and inculcation of a sense of social responsibility. Schools should recognize their responsibility in facilitating the transition of youth from the world of school to the world of work and life;

Vocationalization of secondary education;

The strengthening of centres of advanced study and the setting up of a small number of major universities which would aim to achieve the highest international standards;

Special emphasis on the training and quality of teachers for schools;

Education for agriculture and research in agriculture and allied sciences should be given a high priority in the scheme of educational reconstruction. Energetic and imaginative steps are required to draw a reasonable proportion of talent to go in for advanced study and research in the agricultural sciences;

Development of quality or pace-setting institutions at all stages and in all sectors.

I apologize for the size of the Report. It could have been shorter, but that would have cost more money and time, and delayed action. What the situation urgently calls for is action, and this is what you have always stressed.

With regards,

Yours sincerely,
D. S. KOTHARI

SRI M. C. CHAGLA
Minister for Education
Government of India
New Delhi

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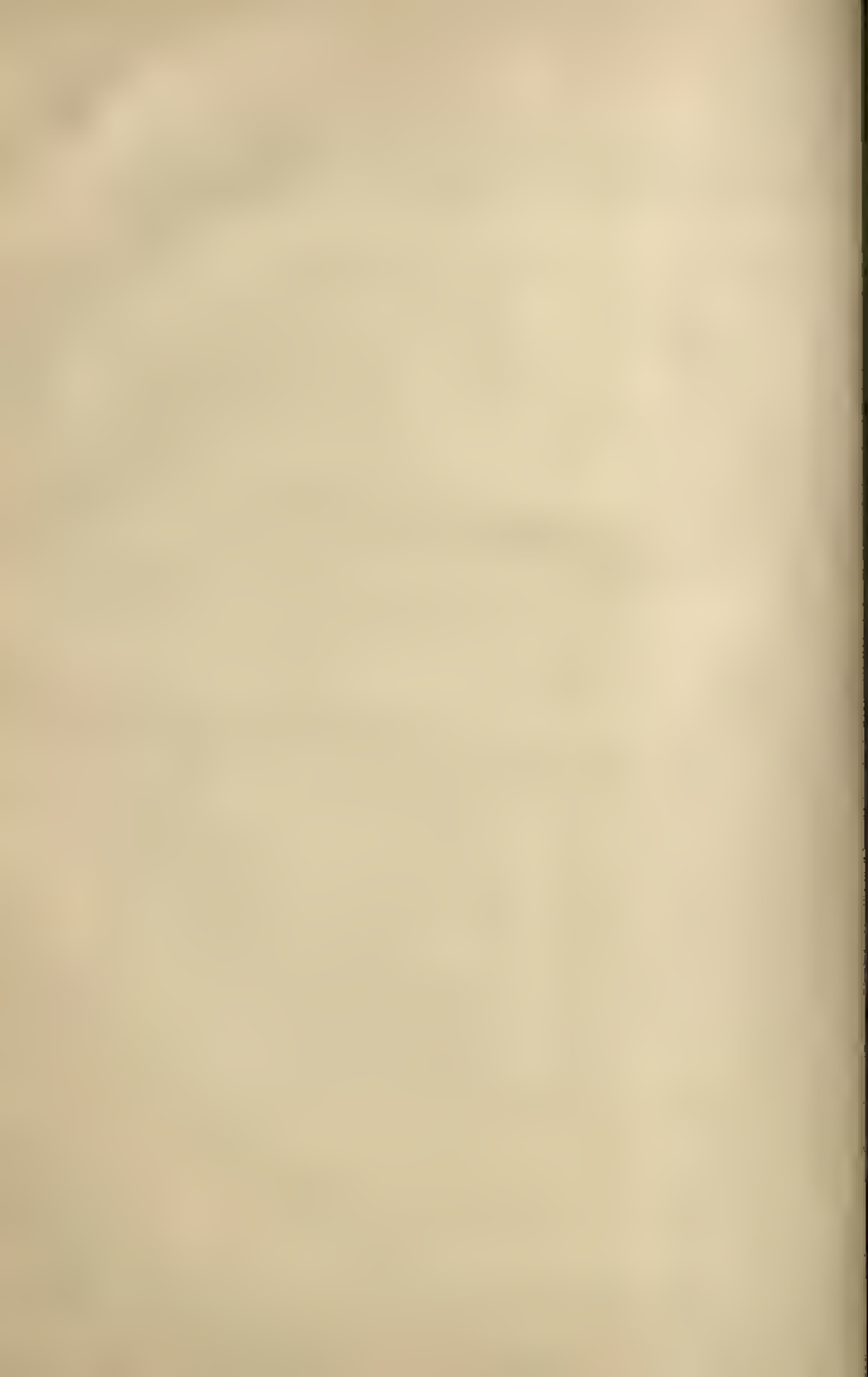
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Associate Secretary

17. MR. J. F. McDOUGALL, Assistant Director, Department of School and Higher Education, UNESCO, Paris.



FOREWORD

The Education Commission was appointed by the Government of India by a Resolution, dated 14 July 1964, to advise the Government on the national pattern of education and on the general principles and policies for the development of education at all stages and in all aspects.*

We began our task twenty-one months ago, on October 2, 1964, Mahatma Gandhi's birthday. From the very beginning we have been conscious of the immensity and inherent difficulties of the task assigned to us. No task in our view could be more challenging, more vital and relevant to India's progress and development—economic, cultural and spiritual. In facing a task of such colossal magnitude and complexity, there is always a danger that the approach and recommendations may not be sufficiently radical. There is also the other possibility that the recommendations may go beyond the capacity and resources of the nation. The difficulties are greatly accentuated because educational plans are long-term plans, and long-term projections of needs and resources are beset with serious uncertainties. We hope our assumptions about the total resources of the nation over the next 20 years and the proportion to be invested in education are reasonable.

It cannot be gainsaid that the recommendations are inevitably circumscribed by the limits of our knowledge and experience, and by our capacity for bold, constructive and imaginative thinking. We would not claim that the recommendations made by us in the Report are necessarily the best, nor can we be completely certain about the validity of every recommendation that we have made. Again, many of the proposals we make would require investigation and revision in the light of experience. We, therefore, lay considerable emphasis on a built-in flexibility in the system of education to facilitate adjustment to changing situations and requirements. There is, of course, one thing about which we feel no doubt or hesitation: education, science-based and in coherence with Indian culture and values, can alone provide the foundation—as also the instrument—for the nation's progress, security and welfare.

Indian education needs a drastic reconstruction, almost a revolution. We need to bring about major improvement in the effectiveness of

*Legal and medical education were excluded from the purview of the Commission, but it was authorized to look into "such aspects of these problems as are necessary for its comprehensive enquiries".

primary education; to introduce work-experience as an integral element of general education; to vocationalize secondary education; to improve the quality of teachers at all levels and to provide teachers in sufficient strength; to liquidate illiteracy; to strengthen centres of advanced study and strive to attain, in some of our universities at least, higher international standards; to lay special emphasis on the combination of teaching and research; and to pay particular attention to education and research in agriculture and allied sciences. All this calls for a determined and large-scale action. Tinkering with the existing situation and moving forward with faltering steps and lack of faith can make things worse than before.

In view of the urgency of the situation, we felt impelled to keep the time-table originally set for the submission of the Report, even if it meant some limitations on the scope of our studies and on the depth and perspicacity of our presentation. If we had more time, the Report could have been shorter and more readable.

The Commission set up twelve Task Forces on (1) School Education; (2) Higher Education; (3) Technical Education; (4) Agricultural Education; (5) Adult Education; (6) Science Education and Research; (7) Teacher Training and Teacher Status; (8) Student Welfare; (9) New Techniques and Methods; (10) Manpower; (11) Educational Administration; and (12) Educational Finance. In addition, it set up seven Working Groups on (1) Women's Education; (2) Education of Backward Classes; (3) School Buildings; (4) School-Community Relations; (5) Statistics; (6) Pre-Primary Education; and (7) School Curriculum. The Task Forces and the Working Groups made a detailed study of many specific problems. Some of these studies will be published separately. The Reports of the Task Forces and the Working Groups have been of great help to us in our work and have enabled us to examine some of the important issues in a depth and detail which would not have been possible otherwise.

We spent about one hundred days in going round all the States and some Union Territories. We visited universities, colleges and schools and held discussions with teachers, educationists, administrators and students. We convened two conferences of university students' representatives to have the advantage of personal discussion with them about student welfare and discipline. We found these conferences of real value.

We interviewed men and women distinguished in public life, scientists, industrialists and scholars in different fields and others interested in education. Altogether we interviewed about 9,000 persons. We invited written evidence, memoranda and replies to our questionnaires, organized seminars and conferences, commissioned a number of special

studies and also conducted a few special enquiries such as the socio-economic background of students admitted to educational institutions, and working days in schools and colleges. The total number of memoranda and notes sent to the Commission was over 2,400.

We had the benefit of valuable consultations with a number of internationally well-known educationists and scientists. We are particularly grateful to Prof. P. M. S. Blackett, President of the Royal Society, UK; Lord Robbins, Chairman of the Committee on Higher Education (1961-63), UK; Sir Christopher Cox, Educational Adviser, Ministry of Overseas Development, UK; Sir Willis Jackson, Professor of Electrical Engineering, Imperial College of Science and Technology, University of London; Professor C. A. Moser, London School of Economics; Professor Frederick Seitz, President, National Academy of Sciences, USA; Dr. James E. Allen Jr., Commissioner, State Education Department and President, University of the State of New York, USA; Professor Edward Shils, University of Chicago, USA; Professor S. Dedjter, University of Lund, Sweden; Recteur J. Capelle, formerly Director-General of Education in France; Professor C. E. Beeby, Harvard University; and Academician A. D. Alexandrov, Rector, University of Leningrad; and Academician O. A. Reutov, Academy of Sciences, USSR.

We had the honour and privilege of meetings with the President, the Vice-President and the Premier Minister. We had most useful discussions with the Minister for Education and some of his Cabinet colleagues and with the Deputy Chairman, Member (Education) and some other members of the Planning Commission. During our visits to the States, the Chief Ministers and Education Ministers as also their colleagues, gave us their time generously. Discussions with them were of great value and benefit to us. We had useful discussions with the Secretaries to State Governments concerned with Education, Local Government, Agriculture and Finance. We also had most useful meetings with a large number of educationists, scientists, the President of the Indian National Congress, Members of Parliament and State Legislatures, industrialists and journalists. To all of them, we are deeply grateful.

In setting up the Commission, the Government of India decided to associate with it a number of distinguished educationists and scientists from other countries. Professors H. L. Elvin (UK), Jean Thomas (France), Roger Revelle (USA), S. A. Shumovsky (USSR) and Sada-toshi Ihara (Japan) served as full members of the Commission. Mr. J. F. McDougall (UNESCO Secretariat) served as Associate Secretary throughout the work of the Commission. The Indian members of the Commission would like to record their deep gratitude to the foreign

members and to the Associate Secretary. It has enabled us to add considerably to our expertise and insight. While the foreign members have been fully and whole-heartedly associated with the work of the Commission and with the general trend of its conclusions, the responsibility rests primarily with the Indian members in cases where we make recommendations pertaining specifically to Indian problems.

Our Report is divided into three parts.

The first part covers Chapters I-VI. It deals with general aspects of educational reconstruction common to all stages and sectors of education. These include reorientation of the educational system to national objectives, structural reorganization, improvement of teachers, enrolment policies and equalization of educational opportunity.

The second part covers Chapters VII-XVII. It deals with the different stages and sectors of education. Chapters VII-X deal with some aspects of school education such as problems of expansion, curriculum, teaching methods, textbooks, guidance, evaluation, administration and supervision. Chapters XI-XIII deal with problems of higher education which include, amongst others, the establishment of major universities, programmes of qualitative improvement, enrolment and university governance. Chapters XIV and XV deal respectively with education for agriculture and technical and vocational education. Chapter XVI discusses programmes of science education and research. Chapter XVII deals with problems of adult education.

The third part deals with problems of implementation. It covers two chapters—Chapter XVIII which deals with educational planning and administration and Chapter XIX which deals with educational finance.

We realize that many of the things we say here have been said before, notably by the University Education Commission (1948-49). It is worth recalling, for instance, that the Commission laid great stress on education for agriculture and its improvement, yet nothing significant happened. The real need is *action*. The poignancy of the situation and the grim times we are passing through underscore this simple but vital fact.

We record our gratitude to the State Governments for their generous cooperation in our work through organizing our visits, making the time of busy senior officials fully available to us, readily answering all our questions, preparing memoranda on their educational progress and problems, opening their institutions to our visits and for their hospitality in making our stay in their States useful and pleasant in every way.

We thank the members of our Task Forces and Working Groups and the Secretary, UGC, for their most willing and devoted efforts to deal with complex problems in a realistic and professional manner. Theirs has been a contribution of inestimable value. We are equally grateful to all those who have given evidence, sent memoranda, replied to the

questionnaires, and discussion papers and participated in seminars and conferences and given us the privilege of visiting their institutions.

We thank the agencies which carried out special studies and enquiries for us and in particular the National Council of Educational Research and Training, the Institute of Applied Manpower Research, the Indian Law Institute, the State Institutes of Education, and the several Teachers' Associations. These added background to our enquiries which we otherwise would have lacked.

Many educational institutions collaborated in a number of special enquiries which the Secretariat of the Commission carried out. Many more opened their doors to our visits and provided the time and experience of their staff to our discussions. We express our gratitude to all of them.

We owe a special debt to the UGC and the Indian Institute of Public Administration who, at considerable inconvenience to themselves, provided us with the necessary accommodation.

It is a pleasure to record our thanks to the UNESCO, the British Council and the USAID for the services of members and consultants and to the Asia Foundation for a gift of books. We have to thank also the UNESCO International Institute of Educational Planning and the Governments of France, the Federal Republic of Germany and the USSR for financial and other assistance to our team which went abroad for comparative studies.

We thank our Secretariat for their selfless and devoted collaboration. A particular word of thanks goes here to the State Liaison Officers for their unstinted help.

We cannot conclude our acknowledgements without expressing our indebtedness to Shri J. P. Naik, Member-Secretary of the Commission. His unrivalled knowledge of educational problems and statistics and his indefatigable energy have been a source of unfailing strength and inspiration; and we owe more to him than to any one else that the work of the Commission could be brought to completion within the allotted time.

We are grateful to Mr. J. F. McDougall, Associate Secretary of the Commission, for his assistance at all stages of our work.



NATIONAL POLICY ON EDUCATION

The Resolution issued by the Government of India on the Report of the Education Commission is reproduced below for ready reference.

Education has always been accorded an honoured place in Indian society. The great leaders of the Indian freedom movement realized the fundamental role of education and throughout the nation's struggle for independence, stressed its unique significance for national development. Gandhiji formulated the scheme of Basic Education seeking to harmonize intellectual and manual work. This was a great step forward in making education directly relevant to the life of the people. Many other national leaders likewise made important contributions to national education before Independence.

2. In the post-Independence period, a major concern of the Government of India and of the States has been to give increasing attention to education as a factor vital to national progress and security. Problems of educational reconstruction were reviewed by several commissions and committees, notably the University Education Commission (1948-49) and the Secondary Education Commission (1952-53). Some steps to implement the recommendations of these Commissions were taken; and with the passing of the Resolution on Scientific Policy under the leadership of Jawaharlal Nehru, the development of science, technology and scientific research received special emphasis. Towards the end of the Third Five Year Plan, a need was felt to hold a comprehensive review of the educational system with a view to initiating a fresh and more determined effort at educational reconstruction; and the Education Commission (1964-66) was appointed to advise the Government on "the national pattern of education and on the general principles and policies for the development of education at all stages and in all aspects". The Report of the Education Commission has since been widely discussed and commented upon. The Government is happy to note that a general consensus on the national policy on education has emerged in the course of these discussions.

3. The Government of India is convinced that a radical reconstruction of education on the broad lines recommended by the Education Commission is essential for economic and cultural development of the country, for national integration and for realizing the ideal of a socialistic pattern of society. This will involve a transformation of the system to relate it more closely to the life of the people; a continuous effort to expand educational opportunity; a sustained and intensive effort to

raise the quality of education at all stages; an emphasis on the development of science and technology; and the cultivation of moral and social values. The educational system must produce young men and women of character and ability committed to national service and development. Only then will education be able to play its vital role in promoting national progress, creating a sense of common citizenship and culture, and strengthening national integration. This is necessary if the country is to attain its rightful place in the comity of nations in conformity with its great cultural heritage and its unique potentialities.

4. The Government of India accordingly resolves to promote the development of education in the country in accordance with the following principles:

(1) *Free and Compulsory Education*

Strenuous efforts should be made for the early fulfilment of the Directive Principle under Article 45 of the Constitution seeking to provide free and compulsory education for all children up to the age of 14. Suitable programmes should be developed to reduce the prevailing wastage and stagnation in schools and to ensure that every child who is enrolled in school successfully completes the prescribed course.

(2) *Status, Emoluments and Education of Teachers*

- (a) Of all factors which determine the quality of education and its contribution to national development, the teacher is undoubtedly the most important. It is on his personal qualities and character, his educational qualifications and professional competence that the success of all educational endeavour must ultimately depend. Teachers must, therefore, be accorded an honoured place in society. Their emoluments and other service conditions should be adequate and satisfactory, having regard to their qualifications and responsibilities.
- (b) The academic freedom of teachers to pursue and publish independent studies and researches and to speak and write about significant national and international issues should be protected.
- (c) Teacher education, particularly in-service education, should receive due emphasis.

(3) *Development of Languages*

- (a) *Regional Languages:* The energetic development of Indian languages and literature is a *sine qua non* for educational and cultural development. Unless this is done, the creative energies of the people will not be released, standards of education will not improve, knowledge will not spread to the people, and the gulf

between the intelligentsia and the masses will remain, if not widen further. The regional languages are already in use as media of education at the primary and secondary stages. Urgent steps should now be taken to adopt them as media of education at the university stage.

- (b) **Three-Language Formula:** At the secondary stage, the State Governments should adopt, and vigorously implement, the three-language formula which includes the study of a modern Indian language, preferably one of the southern languages, apart from Hindi and English in the Hindi-speaking States, and of Hindi along with the regional language and English in the non-Hindi speaking States. Suitable courses in Hindi and/or English should also be available in universities and colleges with a view to improving the proficiency of students in these languages up to the prescribed university standards.
 - (c) **Hindi:** Every effort should be made to promote the development of Hindi. In developing Hindi as the link language, due care should be taken to ensure that it will serve, as provided for in Article 351 of the Constitution, as a medium of expression for all the elements of the composite culture of India. The establishment, in non-Hindi States, of colleges and other institutions of higher education which use Hindi as the medium of education should be encouraged.
 - (d) **Sanskrit :** Considering the special importance of Sanskrit to the growth and development of Indian languages and its unique contribution to the cultural unity of the country, facilities for its teaching at the school and university stages should be offered on a more liberal scale. Development of new methods of teaching the language should be encouraged, and the possibility explored of including the study of Sanskrit in those courses (such as modern Indian languages, ancient Indian history, Indology and Indian philosophy) at the first and second degree stages, where such knowledge is useful.
 - (e) **International Languages:** Special emphasis needs to be laid on the study of English and other international languages. World knowledge is growing at a tremendous pace, especially in science and technology. India must not only keep up this growth but should also make her own significant contribution to it. For this purpose, study of English deserves to be specially strengthened.
- (4) *Equalization of Educational Opportunity*
 Strenuous efforts should be made to equalize educational opportunity.
- (a) **Regional imbalances in the provision of educational facilities**

should be corrected and good educational facilities should be provided in rural and other backward areas.

- (b) To promote social cohesion and national integration the Common School System as recommended by the Education Commission should be adopted. Efforts should be made to improve the standard of education in general schools. All special schools like Public Schools should be required to admit students on the basis of merit and also to provide a prescribed proportion of free-studentships to prevent segregation of social classes. This will not, however, affect the rights of minorities under Article 30 of the Constitution.
- (c) The education of girls should receive emphasis, not only on grounds of social justice, but also because it accelerates social transformation.
- (d) More intensive efforts are needed to develop education among the backward classes and especially among the tribal people.
- (e) Educational facilities for the physically and mentally handicapped children should be expanded and attempts should be made to develop integrated programmes enabling the handicapped children to study in regular schools.

(5) *Identification of Talent*

For the cultivation of excellence, it is necessary that talent in diverse fields should be identified at as early an age as possible, and every stimulus and opportunity given for its full development.

(6) *Work-experience and National Service*

The school and the community should be brought closer through suitable programmes of mutual service and support. Work-experience and national service, including participation in meaningful and challenging programmes of community service and national reconstruction, should accordingly become an integral part of education. Emphasis in these programmes should be on self-help, character formation and on developing a sense of social commitment.

(7) *Science Education and Research*

With a view to accelerating the growth of the national economy, science education and research should receive high priority. Science and mathematics should be an integral part of general education till the end of the school stage.

(8) *Education for Agriculture and Industry*

Special emphasis should be placed on the development of education for agriculture and industry.

- (a) There should be at least one agricultural university in every State. These should, as far as possible, be single campus universities; but where necessary, they may have constituent colleges on different campuses. Other universities may also be assisted, where the necessary potential exists, to develop strong departments for the study of one or more aspects of agriculture.
- (b) In technical education, practical training in industry should form an integral part of such education. Technical education and research should be related closely to industry, encouraging the flow of personnel both ways and providing for continuous co-operation in the provision, design and periodical review of training programmes and facilities.
- (c) There should be a continuous review of the agricultural, industrial and other technical manpower needs of the country and efforts should be made continuously to maintain a proper balance between the output of the educational institutions and employment opportunities.

(9) *Production of Books*

The quality of books should be improved by attracting the best writing talent through a liberal policy of incentives and remuneration. Immediate steps should be taken for the production of high quality textbooks for schools and universities. Frequent changes of textbooks should be avoided and their prices should be low enough for students of ordinary means to buy them.

The possibility of establishing autonomous book corporations on commercial lines should be examined and efforts should be made to have a few basic textbooks common throughout the country. Special attention should be given to books for children and to university-level books in regional languages.

(10) *Examinations*

A major goal of examination reforms should be to improve the reliability and validity of examinations and to make evaluation a continuous process aimed at helping the student to improve his level of achievement rather than at 'certifying' the quality of his performance at a given moment of time.

(11) *Secondary Education*

- (a) Educational opportunity at the secondary (and higher) level is a major instrument of social change and transformation. Facilities for secondary education should accordingly be extended expeditiously to the areas and classes which have been denied these in the past.

- (b) There is a need to increase facilities for technical and vocational education at this stage. Provision of facilities for secondary and vocational education should conform broadly to the requirements of the developing economy and real employment opportunities. Such linkage is necessary to make technical and vocational education at the secondary stage effectively terminal. Facilities for technical and vocational education should be suitably diversified to cover a large number of fields, such as agriculture, industry, trade and commerce, medicine and public health, home management, arts and crafts, secretarial training, etc.

(12) *University Education*

- (a) The number of wholetime students to be admitted to a college or university department should be determined with reference to the laboratory, library and other facilities and to the strength of the staff.
- (b) Considerable care is needed in establishing new universities. These should be started only after an adequate provision of funds has been made for the purpose and due care has been taken to ensure proper standards.
- (c) Special attention should be given to the organization of post-graduate courses and to the improvement of standards of training and research at this level.
- (d) Centres of advanced study should be strengthened and a small number of 'clusters of centres' aiming at the highest possible standards in research and training should be established.
- (e) There is a need to give increased support to research in universities generally. The institutions for research should, as far as possible, function within the fold of universities or in intimate association with them.

(13) *Part-time Education and Correspondence Courses*

Part-time education and correspondence courses should be developed on a large scale at the university stage. Such facilities should also be developed for secondary school students, for teachers and for agricultural, industrial and other workers. Education through part-time and correspondence courses should be given the same status as full-time education. Such facilities will smoothen transition from school to work, promote the cause of education and provide opportunities to the large number of people who have the desire to educate themselves further but cannot do so on a full-time basis.

(14) *Spread of Literacy and Adult Education*

- (a) The liquidation of mass illiteracy is necessary not only for promoting participation in the working of democratic institutions and for accelerating programmes of production, especially in agriculture, but for quickening the tempo of national development in general. Employees in large commercial, industrial and other concerns should be made functionally literate as early as possible. A lead in this direction should come from the industrial undertakings in the public sector. Teachers and students should be actively involved in organizing literacy campaigns, especially as part of the Social and National Service Programme.
- (b) Special emphasis should be given to the education of young practising farmers and to the training of youth for self-employment.

(15) *Games and Sports*

Games and sports should be developed on a large scale with the object of improving the physical fitness and sportsmanship of the average student as well as of those who excel in this department. Where playing field and other facilities for developing a nation-wide programme of physical education do not exist, these should be provided on a priority basis.

(16) *Education of Minorities*

Every effort should be made not only to protect the rights of minorities but to promote their educational interests as suggested in the statement issued by the Conference of the Chief Ministers of States and Central Ministers held in August 1961.

(17) *The Educational Structure*

It will be advantageous to have a broadly uniform educational structure in all parts of the country. The ultimate objective should be to adopt the 10+2+3 pattern, the higher secondary stage of two years being located in schools, colleges or both according to local conditions.

5. The reconstruction of education on the lines indicated above will need additional outlay. The aim should be gradually to increase the investment in education so as to reach a level of expenditure of 6 per cent of the national income as early as possible.

6. The Government of India recognizes that reconstruction of education is no easy task. Not only are the resources scarce but the problems are exceedingly complex. Considering the key role which education, science and research play in developing the material and human resources of the country, the Government of India will, in addition to

undertaking programmes in the Central sector, assist the State Governments for the development of programmes of national importance where coordinated action on the part of the States and the Centre is called for.

7. The Government of India will also review, every five years, the progress made and recommend guidelines for future development.

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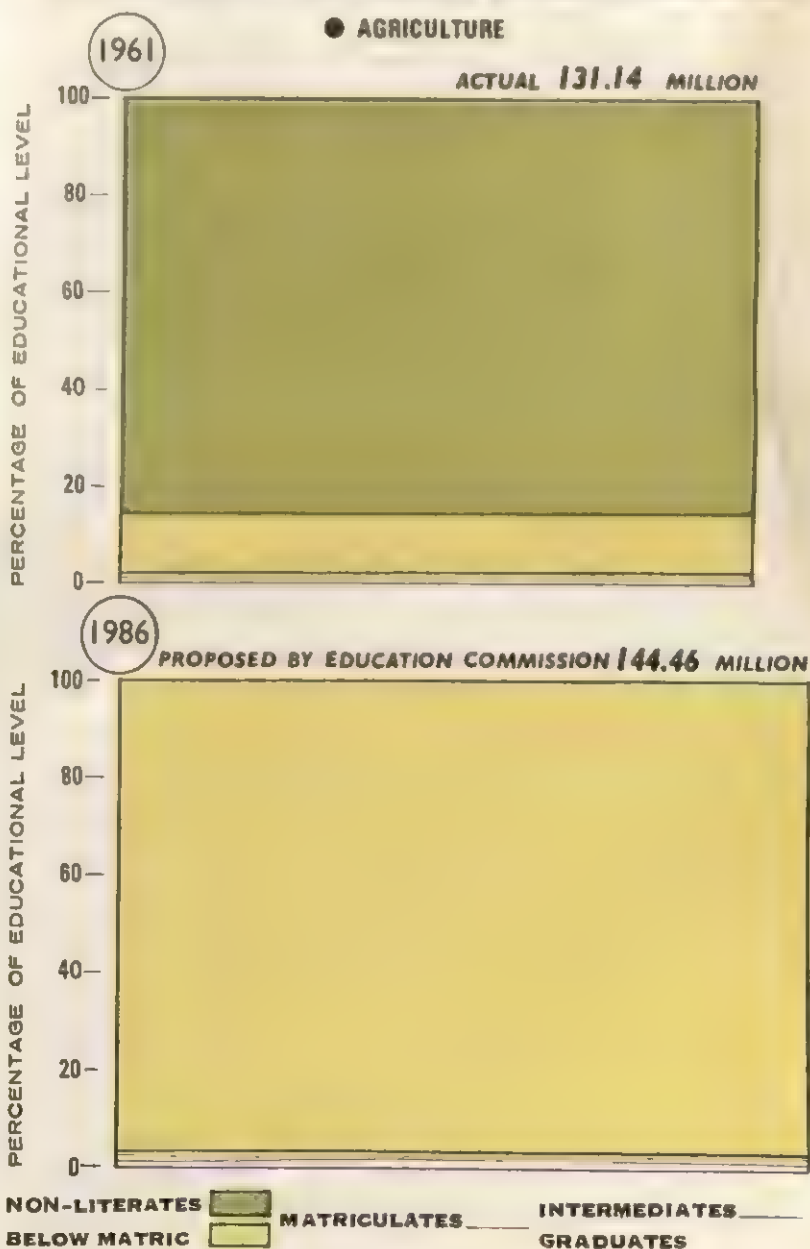
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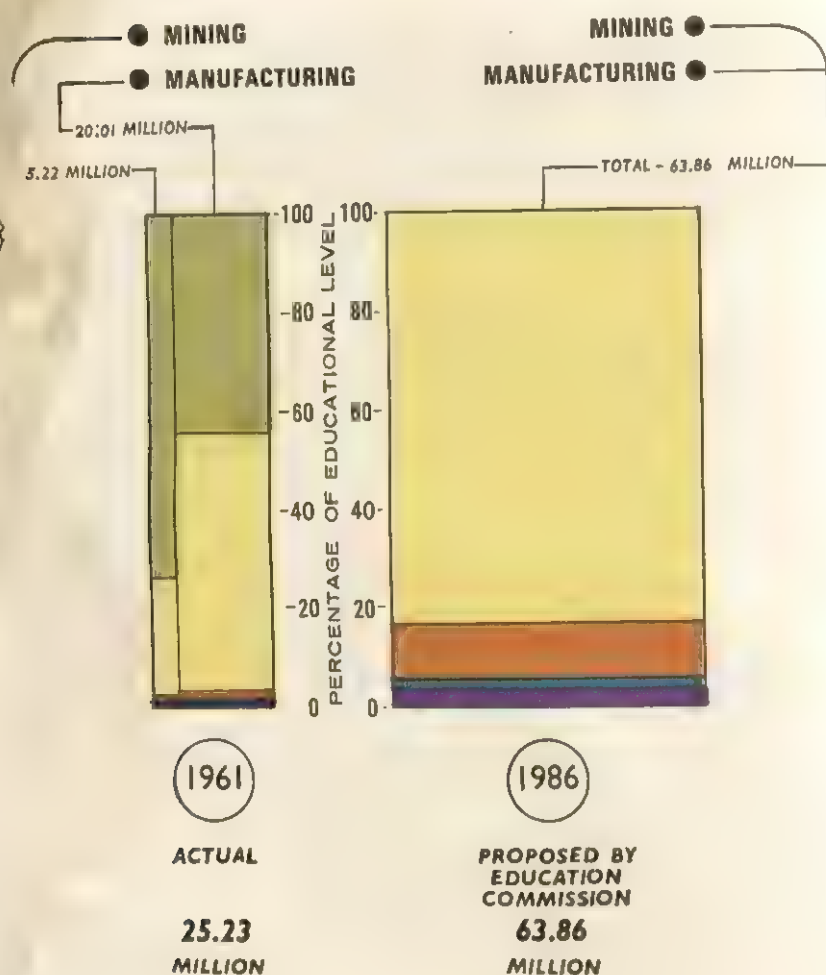
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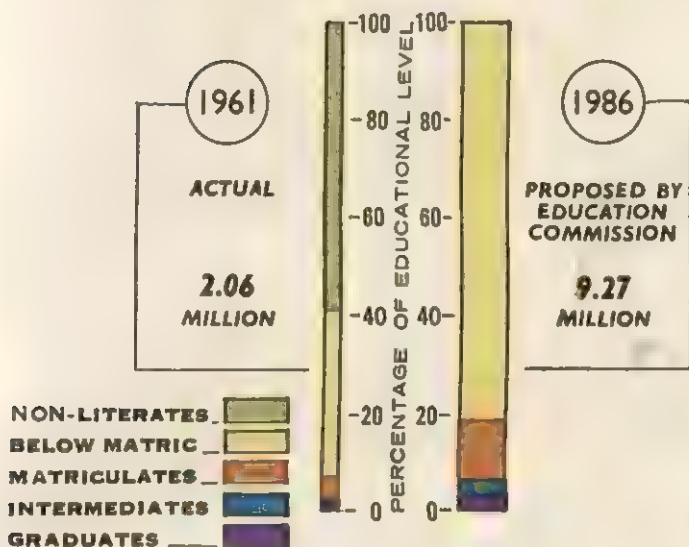


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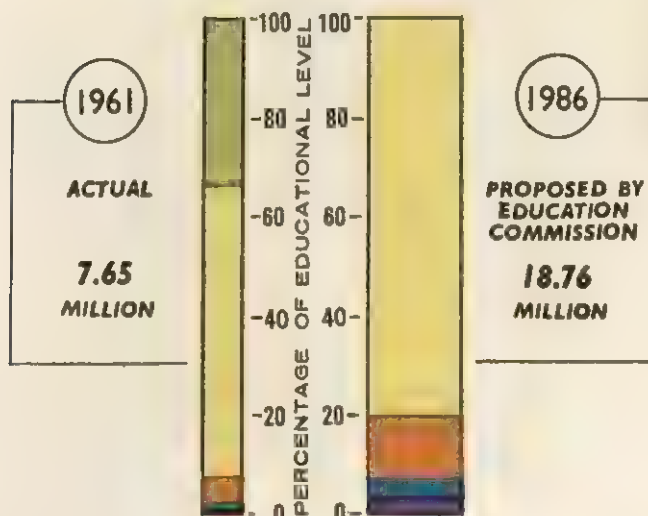


Educational Level of Working Population (India) **1961 (actual) & 1986 (proposed by Education Commission)**

● **CONSTRUCTION**



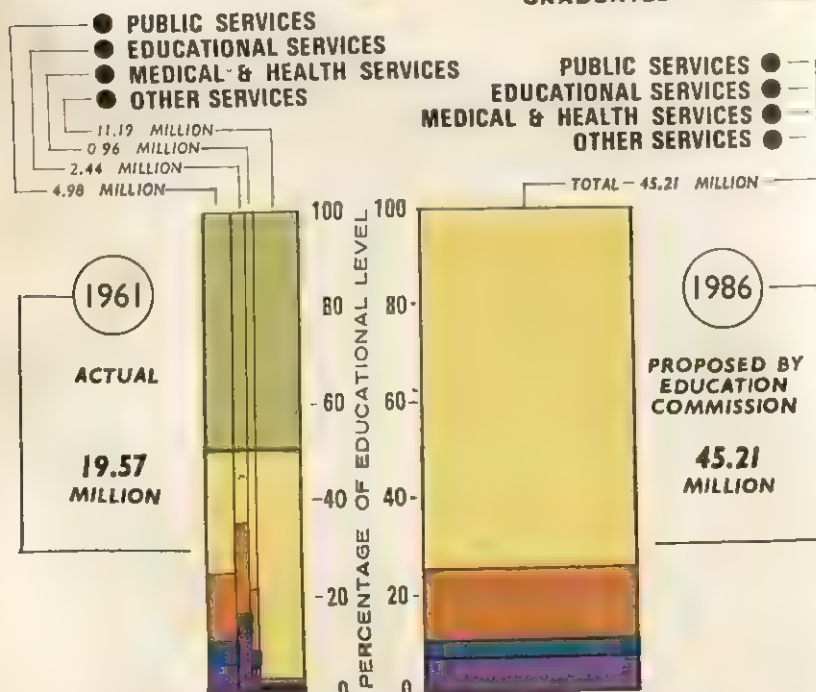
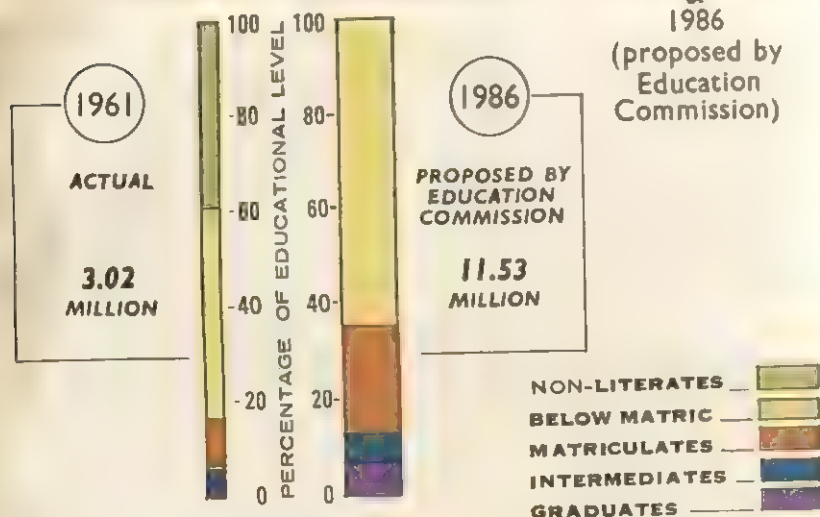
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&
1986
(proposed by
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REPORT OF THE
EDUCATION
COMMISSION
1964-66

PART TWO (Continued)

EDUCATION AT DIFFERENT STAGES AND IN DIFFERENT SECTORS

(Part Two of the Report consists of Chapters VII-XVII. Of these, Chapters VII-X have been dealt with in Volume II. Volume III contains Chapters XI-XVII.)

Chapters XI-XIII. These three chapters deal with problems of university education, both quantitative and qualitative.

Chapter XI deals with improvement of higher education. It covers such topics as the objectives of university education, the scheme of major universities, methods of teaching and evaluation, medium of education and student services (including student discipline).

Chapter XII deals with problems of expansion. It covers such topics as anticipated enrolments at the undergraduate and postgraduate stages during the next two decades, planning and location of colleges, the establishment of new universities, reorganization of courses for the first and second degrees, area studies, development of social sciences, education of women and educational research.

Chapter XIII deals with problems of university government. Amongst others, it discusses the problems of university autonomy, grants-in-aid to universities and private colleges, appointment of vice-chancellors, university legislation, affiliated colleges, and reorganization of the UGC.

Chapters XIV-XVI. These three chapters deal with problems of agricultural and technical education and the development of scientific research.

Chapter XIV deals with development of education for agriculture and covers such topics as agricultural universities, agricultural polytechnics, development of agricultural education at the undergraduate and postgraduate stages, and agricultural extension.

Chapter XV deals with problems of vocational, technical and engineering education. Amongst others, it deals with the training of semi-skilled and skilled workers and technicians through the development of vocational, technical and engineering education at the school stage, the education of engineers (undergraduate and postgraduate stages) and the reorganization of the administration of technical education.

Chapter XVI deals with science education with special reference to the university stage and the development of scientific research.

Chapter XVII. This deals with problems of adult education, including liquidation of illiteracy, provision of facilities for part-time and correspondence education, development of libraries, and the organization of university extension.

CHAPTER XI

HIGHER EDUCATION : OBJECTIVES AND IMPROVEMENT

11.01 Pandit Jawaharlal Nehru, in his convocation address to the University of Allahabad in 1947, thus summed up the basic objectives of the university and its role in national life. 'A university stands for humanism, for tolerance, for reason, for the adventure of ideas and for the search of truth. It stands for the onward march of the human race towards even higher objectives. If the universities discharge their duties adequately, then it is well with the nation and the people.' These great words highlight the basic truth that universities have a crucial part to play in the life, welfare and strength of a nation. The universities can, however, fill this role only if they owe uncompromising loyalty to certain fundamental values of life. They are essentially a community of teachers and students where, in some way, all learn from one another or, at any rate, strive to do so. Their principal object is to deepen man's understanding of the universe and of himself in body, mind and spirit, to disseminate this understanding throughout society and to apply it in the service of mankind. They are the dwelling places of ideas and idealism, and expect high standards of conduct and integrity from all their members. Theirs is the pursuit of truth and excellence in all its diversity—a pursuit which needs, above all, courage and fearlessness. Great universities and timid people go ill together.

11.02 While the fundamental values to which the universities owe their allegiance are largely unrelated to time or circumstance, their functions change from time to time. In the rapidly changing contemporary world, universities are undergoing profound changes in their scope, functions and organization and are in a process of rapid evolution. Their tasks are no longer confined to the two traditional functions of teaching and advancement of knowledge. They are assuming new functions and the older ones are increasing in range, depth and complexity. In broad terms, the functions of the universities in the modern world may be said to be:

- to seek and cultivate new knowledge, to engage vigorously and fearlessly in the pursuit of truth, and to interpret old knowledge and beliefs in the light of new needs and discoveries;
- to provide the right kind of leadership in all walks of life, to identify gifted youth and help them develop their potential to

the full by cultivating physical fitness, developing the powers of the mind and cultivating right interests, attitudes and moral and intellectual values;

- to provide society with competent men and women trained in agriculture, arts, medicine, science and technology and various other professions, who will also be cultivated individuals, imbued with a sense of social purpose;
- to strive to promote equality and social justice and to reduce social and cultural differences through diffusion of education; and
- to foster in the teachers and students, and through them in society generally, the attitudes and values needed for developing the 'good life' in individuals and society.

UNIVERSITIES IN INDIA

11.03 *Historical Development.* The ancient universities in India were leading centres of learning in the contemporary world and attracted scholars and students from other countries. So did some famous centres of Islamic learning in the mediaeval period. But unfortunately these traditions did not survive and the modern universities were established, more than a hundred years ago, as exotic institutions created in imitation of the London University as it then was. The earliest of these were the Universities of Bombay, Calcutta and Madras—all founded in 1857—and the University of Allahabad, founded in 1887. They all began as purely examining bodies and continued to be so till the opening of the present century when the Indian Universities Commission was appointed (1902) and the Indian Universities Act was passed (1904). As Lord Curzon observed: 'How different is India! Here the university has no corporate existence in the same (i.e., as in Oxford or Cambridge) sense of the term; it is not a collection of buildings, it is scarcely even a site. It is a body that controls courses of study and sets examination papers to the pupils of affiliated colleges. They are not part of it. They are frequently not in the same city, sometimes not in the same province.'¹²³ The Government Resolution on Educational Policy (1913) accepted the need for establishing more universities. It said: 'The day is probably far distant when India will be able to dispense altogether with the affiliating universities. But it is necessary to restrict the area over which the affiliating universities have control by securing, in the first instance, a separate university for each of the leading provinces in India and secondly to create new local teaching and residential universities within each of the provinces in harmony with the best

¹²³ Lord Curzon in India, Vol. II, p. 35.

modern opinion as to the right road to educational efficiency.' As a result of this policy, six new universities came into existence between 1913 and 1921. A teaching, unitary and largely residential university was established at Lucknow (1920). Recognition was also given to the efforts made by eminent Indians to break new ground in creating teaching universities. For instance, the Banaras Hindu University, founded by Pandit Madan Mohan Malaviya, was incorporated in 1916 and the Aligarh Muslim University, founded by Sir Syed Ahmed Khan, was incorporated in 1920. In the meanwhile, two princely States also established universities for their areas, Mysore in 1916 and Osmania in 1918, the latter making history by the adoption of Urdu as the medium of education.¹²⁴ After 1921, when education was transferred to Indian control, the development of universities was much faster and during the next 26 years, nine more universities were established. After the attainment of independence, there has been a much more rapid expansion in the field of higher education. The number of universities has increased from 19 to 64. In addition, nine institutions have been 'deemed to be universities' under Section 3 of the UGC Act. The details about these will be found in the note at the end of this chapter. But even this expansion has not fulfilled the needs of the situation.

11.04 *Special Responsibilities.* The general objectives of university education given earlier apply equally to Indian universities. They have, in addition, some special responsibilities in the present state of our social and educational development. First and foremost, they must learn to strive to serve as the 'conscience of the nation', as assessors of the national way of life, and this responsibility becomes all the greater in the absence of an enlightened public opinion. There are so many new pulls and forces (as well as old ones) operating in our national life—as, indeed, in the life of man as a whole—that its balance has become very precarious; and there is a danger of losing our bearings unless universities are able to play this role adequately by involving themselves deeply in the study and evaluation of the social process. Such involvement is vital since the universities are pre-eminently the forum for a critical assessment of society—sympathetic, objective, unafraid—whose partiality and motives cannot be suspected. So far, the Indian universities have not performed this function adequately. This may be due either to apathy or failure to recognize the importance of this role or to the traditional belief that scholarship and academic

¹²⁴ The S.N.D.T. Indian Women's University was founded by Maharshi Annasahib Karve in 1916 and it used Marathi and Gujarati as the media of education. It was, however, incorporated much later in 1949.

excellence thrive only in isolation from the clamour of the multitude. In some cases, an apprehension of the displeasure of the authorities or influential vested interests, which may not take kindly to their opinions and criticisms, may also have worked as a deterrent. To discharge this function properly, the university teachers should cultivate not only intellectual integrity, courage and scientific knowledge but also win public confidence. Unless they have the high ambition to make an impact on the quality of social thinking and endeavour, they will not be able to help in moulding a new society which will not merely cherish high values but actually provide opportunities for living by them. For this purpose, it is necessary, as a first step, to develop the universities themselves into communities where such values are prized and practised.

11.05 From this point of view, the universities must learn to encourage individuality, variety and dissent, within a climate of tolerance. Dissent there is, even now, but usually of a superficial or sensational kind of which many manifestations can be seen in India and abroad. The general tendency, however, is to produce the 'organization man' who is afraid to challenge the accepted pattern of social behaviour and social institutions at the intellectual level and who is too often anxious to worm himself into the good graces of the people who count so that he may be able to 'get on' in life. A university should have no truck with this type of mind. Its business is not primarily to give society what it *wants* but what it *needs* and obviously they are not always identical. It is not a 'community service station', passively responding to popular demands and thereby endangering its intellectual integrity. Nor is it an ivory tower into which students and teachers can withdraw for a time for teaching or research, accepting no responsibility for the improvement of society. It has to maintain an ambivalent position, balancing itself carefully between commitment and detachment - commitment in action, detachment in thought. It must always be in a constant state of creative *tension* knowing where to interpret, where to criticise, where to pioneer and where to support traditional values. It can neither identify itself with the existing environment and institutions, nor yield uncritically to every kind of change, every passing pressure. This would be to surrender its basic integrity of outlook and judgment. It must ever stand ready to assimilate the new that is healthy and to eschew the old that is diseased. Such an attitude is challenging and can be unpleasant, for it needs courage to reject unduly complacent images of one's individual or national life and overcome the many emotional blocks in the mind. The university can play this role adequately if it has faith in the power of the mind and helps others to share this faith. It must encourage, not only in its students but

also in the general public, so far as possible, free and disinterested thinking which can challenge vested interests and established ways. This is the only way which holds out some hope that man will be able to **live wisely and intelligently.**

11.06 Another special responsibility of the Indian universities is to develop programmes of adult education in a big way and, to that end, evolve a wide spread network of part-time and correspondence courses. The universities have to provide these courses in all their faculties, not only as extra-mural preparation for their examinations, but also as programmes of in-service education of professional workers in all walks of life. General adult education programmes are also needed to create a unity of outlook and faith between the masses and the intelligentsia. An extension programme would include provision for training the intermediate leadership groups which, in the circumstances of today, may not be in a position to enter the university but on whose understanding of, and identification with, national problems, the future of the country largely depends. Above all, it will require that universities function as agencies for a deep and careful study of local, regional and national problems, to which Government, public and private organizations and industry, may turn for advice and guidance.

11.07 Yet another responsibility of the Indian universities in the present context is to strive to assist the schools in their attempts at qualitative self-improvement. For this purpose, universities should conduct experimental schools, run advanced courses for teachers in various school subjects, assume greater responsibility for the training of teachers at all levels, organize summer institutes for their in-service education, assist in the search for and development of talent, and develop new curricula, textbooks and teaching materials. These programmes of extension and school improvement have been discussed in detail elsewhere.¹²⁵

11.08 Perhaps the most onerous responsibility which the Indian universities now have is to shake off the heavy load of their early tradition which gives a dominant place to examinations, to improve standards all-round and by a symbiotic development of teaching and research, to create at least a few centres which would be comparable to those of their type in any other part of the world. This alone would help to bring back the 'centre of gravity' of Indian academic life within the country itself. We can do no better than to quote Sir Eric Ashby on this subject:

Looking at Indian Universities a century after their foundation, one cannot but help feel that they have failed to adapt themselves sufficiently to the vast and unique opportunities which surround them;

¹²⁵ Chapters VIII to X (Vol. II) and XVII.

they seem to have lost enthusiasm and initiative under the crushing problems which have beset them. Despite three major commissions, they have not been able to extricate themselves from their own brief history. With a few notable exceptions they remain examining bodies and their students naturally regard success in examinations as the sole end of an undergraduate career. As universities multiply in number, their academic standards—relative to those elsewhere—do not improve. And something even more serious than this happens: the universities remain alien implantations, not integrated into the New India as the writers of the Radhakrishnan Report (in its brilliant second chapter) hoped they might be. This is one reason why, to the observer from outside, the Indian intellectual remains a culturally displaced person, nostalgically treasuring his threads of communication with England. Notwithstanding the fact that the leadership of modern India is in the hands of statesmen more intellectual than perhaps are to be found in any other nation, there is in India (as Edward Shils recently wrote) 'no intellectual community'. This is due in part to the lack of a hierarchy of cultural institutions in the country: and this in turn is related to the fact that the universities have responded too weakly to the challenge of Asiatic culture.

This failure of the university to meet the challenge of Indian society has many complex causes, but among the causes are undoubtedly the decisions made between 1835 and 1854. To exclude from university studies for half a century the whole of oriental learning and religion and to purvey to Hindus and Moslems a history and philosophy whose roots lie exclusively in the Mediterranean and in Christianity; to communicate the examinable skeleton of European civilization without ensuring that the values and standards which give flesh to these bones are communicated too; to set up the external paraphernalia of a university without the warmth and fellowship of academic society: these are the handicaps against which Indian universities are still struggling and which prevent the university from becoming the centre and focus of India's intellectual life.¹²⁶

11.09 The responsibilities we have discussed so far are those which are specially related to higher education and they should be read together with the general objectives of education stated earlier¹²⁷ to which all stages of education must contribute in some measure. For instance, the Indian universities must foster national consciousness. They should ensure 'that every student who passes out of an Indian university takes with him some understanding of India's cultural heritage, its past achievements and triumphs in the field of art, philosophy,

¹²⁶ *The Bulletin of International Association of Universities*, November, 1962.

¹²⁷ Vol. I, Chapter I.

science and so on. He should, in other words, know what he is heir to. This could, perhaps, best be done at the first degree stage where such a study could form a part of a programme of liberal education. It is noteworthy, in this connection, that all university students in America have to take a course in western civilization'.¹²⁸

11.10 We are convinced that a keen awareness of these responsibilities of the universities on the part of all university teachers and students is indispensable to the renovation of higher education we have in view. If we may say so, these are a challenge to the conscience of the university men and women and we trust it will be taken up in all seriousness.

11.11 *Programmes of Development.* To realize these ambitious objectives is no easy task. To do so in all our universities would need an order of investment in physical and monetary terms which is now beyond our reach and a large number of highly qualified and dedicated teachers who are not available. What is necessary, therefore, is a well-conceived and a comprehensive plan spread over the next twenty years and its vigorous and sustained implementation. This plan would include, amongst others, the following programmes which have high priority:

- a radical improvement in the quality and standards of higher education and research;
- expansion of higher education to meet the manpower needs of national development and, to some extent, the rising social ambitions and expectations of the people; and
- improvement of university organization and administration.

We shall discuss these problems seriatim in this and the next two chapters.

SOME PROBLEMS

11.12 There is a general feeling in India that the situation in higher education is unsatisfactory and even alarming in some ways, that the average standards have been falling and that rapid expansion has resulted in lowering quality. The examination results, the reports of Public Service Commissions, the views of employers and the assessment of teachers themselves, the results of research—all seem to support this conclusion. In view of the difficulties inherent in the objective measurement of standards over a given period and as no serious attempt to measure standards has been undertaken so far, it is difficult to say definitely to what extent and in what respects, they have been falling. What is, however, apparent and really matters is that over a large area of education, the content and quality are inadequate for our present

¹²⁸ *Report on Standard of University Education* UGC, New Delhi, 1965, pp. 4-7.

needs and future requirements, and compare unfavourably with the average standards in other educationally advanced countries. What is worse, the large gap between the standards in our country and those in the advanced countries is widening rapidly. Many of our educationists and public men, however, have not fully realized how serious are the actual conditions, academic and physical, that obtain in the colleges and universities. Even those who are broadly aware of the situation, fail to notice its poignancy because they have become used to such conditions. It would, therefore, be useful to describe them briefly.

11.13 The existing situation in higher education during the academic year broadly alternates between slackness and strain—slackness during the session, strain at the time of examinations. In many of the weaker colleges and universities, a majority of teachers teach mechanically and listlessly. The subjects in which they lecture do not often involve their intellectual passion. They do not usually have a part in the formulation of the syllabus which they are required to teach, nor do they make—with a few bright exceptions—experiments in methods of teaching. There is little enthusiasm for learning or discovery of new truths because research is not considered an integral part of their duties and whatever research is done is usually of unconvincing quality. In the absence of a 'research impregnated' atmosphere, even the intellectually ambitious younger members of the staff are soon caught up in the general atmosphere of indifference or cynicism. A large proportion of teachers suffer from financial worries—particularly in colleges where grades are low—and are often unable to buy any books or journals. Even the physical conditions of work discourage serious, undistracted study or intellectual dialogue with their colleagues. Usually, there is one staff common room which is not large enough even to accommodate all the members of the faculty. In some of the institutions, there are additional factors which are uncongenial for the development of intellectual vitality. The hierarchical concentration of authority within the departments and colleges, the atmosphere of distrust between senior and junior teachers, the cynicism about administrative authorities, the unseemly conflicts about offices and positions and the attitude of envy towards persons of superior attainments—all have contributed to the deadening of the spirit of intellectual curiosity and adventure. Some of the members are diverted from intellectual concerns into intrigue and conflict over the small administrative or financial prizes afforded by Indian academic life. On top of all this, the bureaucratic structure within which research has to be done, the dependence on the approval of indifferent superiors, the elaborate procedures through which equipment made abroad has to be obtained, the difficulties in the maintenance and repair of equipment once obtained and in establishing contact with researchers working

on related subjects, have all had a depressing effect on the morale of teachers and on the quality and quantity of their research output.

11.14 The situation with regard to the students is no better. Many now come from comparatively or entirely uneducated homes and are ill-prepared at the secondary level to undertake genuine university work; they have little experience of independent study; their curiosity is not quickened and learning for them is mainly a matter of mechanical memorization. There is, as a rule, little discussion of intellectual matters with their teachers or fellow students; their main duty is considered to be to attend uninteresting lectures usually given in a language which they understand inadequately. When the medium is an Indian language, there is a dearth of suitable textbooks and supplementary literature necessary to achieve competence in their subjects. Many of them cannot be expected to read textbooks in English because it has not become for them the language of the library. The capacities of the better students are not fully stretched by curricular offerings or the stimulus which inspiring teachers could provide. In addition, a large majority of students are beset with financial worries which make concentration on academic work difficult.

11.15 This may appear an exaggerated picture. But it is not. If anything, it errs on the side of underestimation. It is, of course, true that there are bright exceptions to this dark picture which one must gratefully acknowledge. But taken all in all, the ideal of academic excellence is confined to a minority of teachers and students who have to keep it alive against the downward pressure of discouraging circumstances.

11.16 This situation has been in existence for a long time. What is new is the magnitude of the problems and their accentuation as a result of the extraordinarily rapid expansion of higher education and the development of new expectations in the post Independence era. In the past, the need for a better, more effective education was not felt so keenly because, so long as India did not supply the higher cadres of its own ruling class—or did so to a limited extent—the efficiency and effectiveness of its intelligentsia was of secondary importance from the point of view of the tasks it was expected to perform. Now that the responsibility for the progress of the country squarely rests on us we cannot afford to plead any alibis. The quality of education, therefore, becomes of crucial significance. As the number of jobs and positions to be filled with highly trained persons increases, the gap between need and the capacity to meet the need is widening. It is obvious that, if higher education is not radically improved, our administration and technical progress, our intellectual standards and social advance will all be most seriously handicapped.

NEED FOR MAJOR UNIVERSITIES

11.17 *The Proposal.* While the need to improve higher education is widely recognized, difficulties begin when one tries to discuss the remedies. The most common suggestions put forward in this regard are usually just the reverse of the defects described above. They try to bring the needed reforms into being through administrative measures, without taking into account the limited resources of finance and personnel available for such reforms or the administrative and political inhibitions operating against their realization. Indeed, it might be said without much exaggeration that many of the proposed remedies presuppose the existence of conditions which, if they really existed, would have made the reforms unnecessary! It is, therefore, imperative that we should adopt some new plan of action which would be both realistic and effective.

11.18 The new strategy that we propose has two important aspects. The first is the need to concentrate scarce human resources and not to scatter them over too wide an area. Even at present, our universities and colleges produce a small number of outstanding Indian scientists and scholars who, if they were to enter upon an academic career under the right conditions, would be able to make a great contribution to the improvement of our academic standards. But, apart from the fact that they are too few compared to our inherent national capacity and our population, they are unfortunately scattered thinly and at random over the entire system of higher education and have to work in comparative isolation and under unfavourable conditions; the burden of a heavy teaching load; large classes of unchallenging students; apathetic or intellectually unambitious colleagues; and an administrative system which intentionally or unintentionally does not encourage and, in some cases, even actively discourages high intellectual vitality and motivation. The able persons, who could have provided the required leavening, are thus rendered ineffectual when they are so scattered and what is worse, their own creative powers decay under such conditions. On the other hand, experience has shown that the best results follow where a goodly number of persons or high potentialities come together in face-to-face intellectual communities and, by their constant dialogue and communication, stimulate each other to put forth their best creative efforts. If there is high quality of personnel, it makes all the difference whether people work in relative isolation resulting eventually in stagnation or in vigorous self-activating groups.

11.19 The most important reform that we envisage is the development of five or six of what we may call 'major' universities where conditions may be provided, both as to staff and students as well as to

the necessary equipment and atmosphere, to make first-class postgraduate work and research possible. The standards of these major universities should be comparable to the best institutions of their type in any part of the world so that really gifted and promising students need not normally have to go abroad for receiving postgraduate or research training. We consider that the development of a few of the most promising universities in India (including, we hope, one of the IITs and one agricultural university) to such a standard within the next ten years is definitely practicable and should be taken up as a matter of high priority.

11.20 Why do we make this proposal and regard it as crucial at this stage? There would be several advantages in creating such universities. In the first place, they would make their existence felt by their research and by the high standards of training which they would provide for their students. They would also supply a goodly portion of the outstanding personnel needed for the staffs of universities, colleges and other institutions of higher education. In this way, their graduates may be expected to infuse into them the standards acquired in their own universities and to spread the ethos of genuine intellectual activity and devotion into the institutions where they are employed. It is unfortunate that, at present, there are hardly any such universities in the country which perform this vital and catalytic role in the Indian academic world.

11.21 One important advantage of these universities is that we would be able to provide, within the country itself, first-rate postgraduate education comparable to that in educationally advanced nations. The scholars and scientists trained in these universities will feel much more akin to their own centres of creativity. The importance assigned to foreign degrees, whether they are of high or average or poor quality, will be considerably diminished and those who have not 'returned' from abroad would not feel at a disadvantage. We realize that it will still be necessary for Indian scientists and scholars to go abroad for purposes of further training, research or for consultation with their foreign colleagues. We have made certain proposals in the scheme of scholarships for this purpose. But instead of going abroad to receive first-rate postgraduate education,¹²⁹ study abroad will primarily aim at bringing first-class Indian scholars to work with distinguished scholars of international reputation.

11.22 This concept of providing first-rate postgraduate education to talented young persons within the country received strong support

¹²⁹ According to the latest available information, 15,393 Indian students and trainees were studying in foreign countries on 1-1-64. Of these, 1,353 students were studying arts, 1,652 were studying science, 4,191 engineering and technology, and 1,402 medicine and veterinary science. The number in the USA was 7,153, in West Germany 4,000, in the U.K. 2,798, in Canada 418, in France 123 and in the USSR 76.

from Prof. I. Seitz, President of the U.S. Academy of Sciences, and Prof. P. M. S. Blackett (President of the Royal Society). It would be worth while to quote from the convocation address to the University of Leeds (England) delivered by Prof. Blackett in 1964. His remarks may or may not apply to some developing countries, they are certainly **relevant to Indian conditions**:

There are three reasons why it seems to be exceedingly important that all developing countries should attempt as soon as possible to create facilities in the major subjects for first-class higher degree work, so that normally a student takes his higher degree in his own country. First, the present widespread practice of sending most bright students overseas to take a higher degree makes it difficult to build up native research schools in the universities because an adequate supply of research students is the lifeblood of a creative university postgraduate department. Following this it will be difficult to keep good staff unless they have an adequate number of postgraduate students. Second, the loss of trained people to the developing countries, by overseas students not returning to their homeland after taking their higher degrees abroad, will be reduced. Third, it will save much foreign exchange. A three-year Ph.D. course will cost some £ 3,000, taking fees, maintenance and fares into consideration, and this is a direct drain on foreign exchange whether the money is provided by the State or privately.

11.23 In addition, these universities would help Indian academic life to come into its own. At present, the 'centre of gravity' of Indian academic life is largely *outside* India. That is to say, our scholars and scientists working in fields which are internationally cultivated still tend to look outside India for judgment of their work, for intellectual models of the problems which they study, for the books they read, and for their forum of appreciation and approval. This is damaging to our academic life in a number of ways. First, Indian problems are not seen in their concreteness and particularity and, as a result, techniques and theories are not adapted to the Indian situation. Secondly, Indian academics suffer from a certain lack of self-esteem and lose the confidence and courage necessary to try out new ways of attacking intellectual problems. When these major universities, comparable to the best in any part of the world, have come into existence, we venture to hope that our scientists and scholars, instead of having to look to Oxford, Cambridge or Harvard or Moscow or Paris for inspiration, would be able to look to centres within our own country for similar stimulation and guidance. This would be a change of the greatest significance. Once the stimulus has become 'Indianized', it could act much more continuously and be less dependent on costly and infrequent personal

contacts. Also, by becoming naturalized in the Indian environment, it will be directed more confidently towards problems to which our scientists and scholars could give themselves without feeling dislocated from their *milieu*.

11.24 This should not be taken to imply that we wish to promote any intellectual isolation or chauvinism—that will be the road to intellectual anarchy and disaster. No country, however outstanding its scientific and scholarly accomplishments, can be entirely self-sufficient. But there is a great difference between participation in the world intellectual community simply from the periphery, as a reproducer or a marginal contributor to what has been discovered or invented elsewhere, and participating as an equal in a process of creating, giving and receiving. We should strive for the latter position.

11.25 A possible objection to these proposals may be that what is proposed here is not quite democratic, that it seeks to institute a system of elite education by favouring certain institutions and impoverishing others. We recognize that our approach does involve at this stage a certain differentiation between the universities. This is, however, not only inevitable in an economy of scarcity but is also the only sure and practicable way to benefit all ultimately in the shortest time possible. Moreover, we must recognize that pursuit of excellence implies and requires a discriminatory approach; and that to provide equal resources to all irrespective of the quality of their performance and potentiality for growth merely promotes mediocrity. We are trying to establish a democratic social order in our country and obviously a democracy cannot flourish unless it has at its disposal the services of a highly trained and powerfully motivated educated class. Unless a system can be devised which will produce such persons in much larger numbers than is being done at present, every aspect of the country's development will be prejudicially affected. In fact, we may go further and say that there is always need for elite from Chicago, Harvard and Columbia. The upper stratum of American higher education was developed in the first quarter of the present century, largely by the Ph.D.s from Chicago, Harvard and Columbia. The development of British higher education in the first half of the present century was largely due to the fact that, until recently, the staff of the new universities in most subjects was supplied by the universities of Oxford and Cambridge which, by 1900, had taken their place as distinguished centres of scholarship and high standards of teaching.

11.26 *Implementation.* We must now examine how these major universities can be developed within the relatively short period of about a decade. The idea of establishing new universities for the purpose

should be ruled out as it would involve a large and avoidable capital expenditure and delay the entire process of the improvement of higher education. The first step in the programme would, therefore, be for the UGC to select, as soon as possible, from amongst the existing universities, about six universities (including one of the IITs and one agricultural university) for development as major universities.

11.27 A university selected for such development will have to do several things. It must make an effort to recruit students sufficiently qualified and endowed mentally to benefit from the superior training to be given. It must get together as quickly as possible an intellectually distinguished group of teachers who will be able to provide the requisite training and make valuable research contributions. And it should make an effort to provide adequate facilities and satisfactory conditions of work. We shall examine these three essential conditions briefly.

11.28 *Recruitment of Students.* At present our students tend, by and large, to be recruited locally or on a State-wise basis and except for a few all-India institutions, the small number of students of superior capacity are usually swamped by the large numbers of those who are not well prepared for intensive higher education. In such a situation, many of the good students lose their motivation for intellectual work and neither fulfil their own potentialities nor stimulate one another adequately as they normally should in a good institution. They are not numerous and powerful enough to offset the downward drag of the uninterested or apathetic students, and instead of pulling the others upward, they themselves tend to become submerged in the mass. A major university of the kind we contemplate should have a 'critical mass' of students of outstanding capacity and promise. This is possible only if they are recruited on an all-India basis. We, therefore, recommend that a national scholarship scheme combined with a placement programme should be organized—the scholarships being tenable only at the major universities or at others where well-developed centres of advanced study (to be discussed later) exist or in their approved constituent or affiliated colleges. The amount of these scholarships should cover all costs of university education, e.g., tuition and other university fees, maintenance, and allowance for textbooks and a small allowance for personal expenses.

11.29 Each major university should be assigned a number of scholarships for the undergraduate stage which will provide it with enough talented students for its postgraduate classes. The actual number may be decided for each major university by the UGC from year to year, in view of all the factors involved. Of these scholarships, about half should be from outside the area of the university and half for students

from inside its area. To avoid loss of time, a beginning may be made by making use of the existing examinations conducted by the universities and the State Boards of Secondary Education supplemented by other data as recommended elsewhere. As far as possible, students should be selected from all the States and Union Territories. Each university may, if it considers it necessary, administer a special test for the purpose or all the major universities may jointly organize a national test as the IITs are doing at present. The scholarships must be continued at the post-graduate level where smaller numbers are involved but the difficult problem of adjusting the standards of different universities has to be tackled.

11.30 *Recruitment of Staff.* In building up a major university, it will be necessary to conduct an energetic search throughout the country for outstanding and promising young persons for its teaching and research staff. We recommend that each department or faculty should have a specially appointed personnel advisory committee, which would work in close collaboration with the appointing authorities of the university, to find faculty members in fields in which it is already distinguished or in which it seeks distinction. It should have, as a major responsibility, the search for the most outstanding and promising Ph.D.s, M.A.s and M.Sc.s, and even brilliant recent graduates. The great merit of such committees lies in their informality and freedom from rigid procedures and this should be fully ensured. They should scrutinize the lists of Indians abroad and the candidates available within the country and the search for staff, instead of being limited to the State or the region, should be made nation-wide and, in a sense, world-wide. They should actively seek such candidates for appointments and, wherever necessary, offer them advance increments. What is even more important, they should be assured of research opportunities, opportunities for study leave and the possibility of achieving professional excellence. There should be room for flexibility in the appointments and promotions. The UGC should place at the disposal of each university a contingency fund which may be used to provide more attractive salaries to persons of exceptional promise and performance. However, the tendency to use it simply to reward or promote persons who have passed the peak of their creative powers should be strongly resisted. Moreover, it should be open to a university, on the advice of the Head, to reduce the number of posts for lecturers or readers and to use the money so saved to appoint additional professors where this is justified. Care should also be taken not to appoint men on an emergency basis. For instance, the appointing authorities should never say: 'This post *has* to be filled; and, we hope, this person will be good enough'. It is better to leave a post

unfilled or to make some temporary arrangements than to fill it with a person whose main qualification is availability. It is only 'inspired men—found, rewarded and planted firmly in the classroom—who can and undoubtedly will give . . . our (universities and) colleges a new lustre, built on the mysterious moments when mind confronts mind and a student suddenly senses the power and richness of his own intellect.'¹³⁰

11.31 *Centres of Advanced Study.* Partly as a preparation and partly as a consequence of the establishment of these major universities, it is necessary to strengthen and expand the UGC programme of the establishment of centres of advanced study. One way of doing this will be to establish 'clusters' of advanced centres in some of the universities as has been done, for instance, in Delhi University. They will add strength to, and enrich, one another and be specially helpful in promoting interdisciplinary research. In other cases, a cluster of centres may not be possible and we may have to begin with a single centre. While these centres will be mainly concerned with postgraduate teaching and research, every care should be taken to see that they do not become isolated from the rest of the university and do not develop a kind of academic snobbishness towards other departments or undergraduate teaching. In fact, they are essentially meant to help in raising the standard of the departments and the university as a whole. We would recommend the establishment of about fifty such centres, including some in modern Indian languages over the next five to ten years. At least one of them should concentrate on developing an interdisciplinary approach to education. The other areas which are not covered in the scheme at present are agriculture, engineering, medicine and modern Indian languages. We recommend that the scheme should be extended to these also.

11.32 *Provision of Facilities.* We need hardly emphasize that it will be necessary to provide adequate facilities and satisfactory conditions of work for this critical mass of gifted students and teachers assembled in the major universities. The programme need not necessarily be very costly, especially if the emphasis is on austerity and utility rather than on ostentation and luxury. In fact, we look forward to the major universities giving a lead in reducing expenditure on buildings and equipment.

11.33 *Some General Suggestions.* We would like to make the following suggestions regarding the selection, periodical review and management of the centres of advanced study:

¹³⁰ Times Educational Supplement.

- (1) The administration of a centre, subject to the overall supervision of the university's Executive Council, should be the responsibility of its director assisted by a small but representative committee of his colleagues. This should consist of all the professors in the department and a number of readers and lecturers elected by the staff. We suggest that it might meet at least three times a year to discuss the academic programme of the department and related matters, its proceedings being circulated to the faculty of the Academic Council. In fact, the setting up of such departmental committees would be useful in all departments, whether it has a centre of advanced study or not.
- (2) A centre once established should not be taken to mean that it will continue to be there irrespective of its work and performance. The privilege of being a centre of advanced study must, as it were, be continually earned and deserved.
- (3) The original selection of a university department as a centre should be made on the basis of the quality and extent of work already done by it, its reputation for good teaching, its contribution to research and its potentiality for further development. The process of selection should be so devised that it will win the confidence of the universities and the academic community generally.
- (4) Each centre of advanced study should have, say, once in three to five years, a visiting committee, consisting of outstanding Indian and, where possible and necessary, foreign experts who will conduct a review and appraisal of the accomplishments of the centre. These visiting committees should not include members of the centre under review and they must not hesitate to be outspokenly critical where such criticism is called for. Above all, they must concentrate on offering positive suggestions for the improvement of teaching and research within the centre.

11.34 *Extension of Excellence.* Steps should be taken to ensure that the standards of the centres of advanced study, whether in the major or other universities, are extended, as early as possible, to other departments and to affiliated colleges. For this purpose, we make the following suggestions:

- (1) The centres within a university should function in close collaboration with other centres and departments which are not centres of advanced study and measures should be adopted to involve the entire staff of the university in functioning as an intellectually effective community.

- (2) The major universities should constantly strive to enlarge the area of their excellence. For this purpose, they might be given a grant in proportion to the number of centres they already possess, to be used for the purpose of raising other departments within the university to their level. Such grants, given in the first instance, for five years for what we might call 'aspirant centres' should be used for the recruitment of adequate staff and the acquisition of equipment and books. They may be renewed for a second five-year period if the progress is satisfactory.
- (3) Centres for advanced study should seek to bring the relevant teachers of their affiliated colleges into closer contact with their work. We suggest that the better qualified and more interested teachers of the affiliated colleges should be encouraged to attend staff and postgraduate seminars of the centre.¹³¹ Opportunities for research within the framework of the centre should be provided for college teachers if they are judged to be qualified for the purpose and their research schemes are approved. They should have the privilege of using the facilities of the centre to supplement the resources of their colleges. Study leave should be permitted for this purpose and, where the college cannot afford to pay the teacher's salary, the expenditure may be met out of the funds of the centre. It should also be possible to make available, to the major universities, specially earmarked grants for the upgrading of their colleges out of the funds allocated by the UGC for the improvement of colleges. If, in spite of all the guidance and assistance provided, the colleges fail to improve and to produce the desired results, the universities should seriously consider the possibility of using their powers to disaffiliate them.

11.35 *Financial Support.* It is obvious that the development of these major universities, as indicated above, will require considerable investment of funds in capital expenditure and the running costs will also be heavy. It is essential that the expenditure required for their development—both capital and recurring—should be placed at the disposal of the UGC by the Central Government.

IMPROVEMENT OF OTHER UNIVERSITIES AND AFFILIATED COLLEGES

11.36 Side by side with the development of these major universities and centres of advanced study, measures must also be adopted to ensure

¹³¹ This privilege should also be extended to postgraduate and advanced third-year undergraduate students of these affiliated colleges.

that the excellence generated in them is gradually extended to other universities and affiliated colleges so that standards in the entire system of higher education are upgraded in due course. It is to the discussion of this second part of the programme for the improvement of higher education that we now turn.

11.37 Teachers for Higher Education. One of the important contributions which the major universities can make to the development of the other universities and affiliated colleges, as pointed out earlier, is to provide them with teachers of quality. Steps have to be taken to ensure this and for this purpose, we make the following proposals.

- (1) Every effort should be made to induce talented students from the universities to join the teaching profession and to place a majority of them in universities and colleges, other than their own, so that they can help to raise standards. The UGC should maintain a central clearing-house agency for the purpose and supply the data about these young scholars to universities and colleges and supply them with information about available jobs.
- (2) With a view to facilitating the recruitment of outstanding persons to the teaching profession, the UGC should sponsor a scheme for instituting a number of fellowships for the purpose. The fellowships should be at three levels: lecturers, readers and professors. Outstanding persons, who may otherwise be lost to the profession, should be granted these fellowships and seconded to work in suitable departments of universities, care being taken to see that they are appointed against permanent posts as early as possible.
- (3) The universities and affiliated colleges should be encouraged, so far as possible, to pre-select their new teachers and attach them to the major universities for about a year during which period they will come into contact with some outstanding teachers in their own and allied fields, will receive orientation towards their chosen profession and perhaps study schemes and techniques of research adopted there.

In course of time, as the graduates of the major universities and centres of advanced study find appointments in the other universities and colleges, they will carry over their traditions of work and scholarship to their colleges and it is likely that they will be more actively receptive to the new ideas emanating from their universities and more disposed to enter into an intellectual dialogue with them. The influence of the major universities will thus pass into other sectors of higher education and help in raising standards.

11.38 This process of extending the standards of the major universities should be fostered by the UGC by adopting, amongst others, the following devices:

- (1) Strong inter-university links should be formed among members of the centres of advanced study, members of aspirant centres, leading university departments and outstanding affiliated colleges, in particular fields of research. For this purpose, small two- to three-day conferences at which a few papers are presented and a critical and constructive discussion forms the main part of the agenda, should be encouraged on a fairly large scale. The funds required for the purpose should be included in the grants to the centres.
- (2) Invitations may be given to promising scholars and scientists from other universities or affiliated colleges to do research and to conduct seminars (say, for a term or a session) at one of the centres of advanced study. It would contribute to their intellectual refreshment and give an incentive to the staff of the other universities and colleges to strive to win the distinction and the advantages of such an invitation.

11.39 *Development of Other Universities.* The universities, which are not major universities, should also strive to develop high standards, to begin with, at least in one or two departments, by due concentration of resources and by securing competent teachers. If they do so, the UGC should give them special grants on the basis of merit. When a university department is thus raised to a high level, its further elevation to the status of an aspirant centre may be considered; and, if it satisfies the conditions laid down, it may be assisted financially for a period of five years in the first instance. If its progress is satisfactory, the department could be developed, in due course, into a full-fledged centre of advanced study. We hope that once this process starts, it will be possible to raise a number of the universities to a reasonably high standard by the end of the century.

11.40 *Development of Affiliated Colleges.* We have to recognize that the standard of the first degree and other postgraduate work in the bulk of affiliated colleges cannot be, in general, the same as that of the education imparted in university departments. The latter will usually have a more balanced combination of teaching and research than in a college, better staff, better qualified students and better resources.

11.41 At the same time, there are several colleges of long standing which have done and are doing as good work as any good university and it should be an objective of educational policy to encourage them.

The major universities should specially help them in every possible way. They will get many of their teachers from them and will be inevitably drawn in a healthy competition for raising standards. To assist in this process, we make the following recommendations:

- (1) Affiliated colleges should be classified in terms of the level of their performance. For instance, the criteria for this purpose may, amongst others, include:
 - number and quality of staff;
 - number and general quality of students;
 - research output;
 - library facilities;
 - laboratory facilities for science students;
 - quality of student discipline;
 - performance of graduates of the college in national scholarships examinations;
 - innovations in teaching procedures; and
 - examination results.

The techniques of applying the above criteria in practice must be worked out and the institutional machinery for the quinquennial reviews of colleges on this basis must also be adequately provided. This classification should be used to provide special 'merit' grants to deserving colleges. For example, colleges which rank high on the list and continue to improve their programmes and teaching should be given certain advantages such as salary bonuses for their teachers, grants for libraries, laboratories and necessary amenities for staff and students, etc., or colleges which have maintained a good and effective library system for a period of, say, five years could be given matching grants to improve their libraries further. Similarly, colleges which, while maintaining other academic standards, have avoided serious breaches of discipline, might be given outright or matching grants for improved staff and student amenities, and so on. We are aware that such a system of college classification and grant-in-aid is beset with administrative difficulties. We, therefore, recommend that the UGC, in consultation with the universities and State Governments, should examine this question of classification of colleges in terms of level of achievement and make use of it in the allocation of grants to colleges under the Fourth Five Year Plan.

- (2) Finally, we should like to refer to the question of 'autonomous' colleges which has been under discussion for many years. Where there is an outstanding college (or a small cluster of very good colleges) within a large university which has shown the capacity to improve itself markedly, consideration should be given to

granting it an autonomous status. This would involve the power to frame its own rules of admissions, to prescribe its courses of study, to conduct examinations, and so on. The parent university's role will be one of general supervision and the actual conferment of the degree. The privilege cannot be conferred once and for all—it will have to be continually earned and deserved—and it should be open to the university, after careful scrutiny of the position, to revoke the autonomous status if the college at any stage begins to deteriorate in its standards. We recommend that provision for the recognition of such autonomous colleges be made in the constitution of the universities. It should be possible, in our opinion, by the end of the Fourth Five Year Plan, to bring at least fifty of the best colleges under this category.

IMPROVEMENT² OF TEACHING AND EVALUATION

11.42 *Improvement of Teaching.* One of the most important reforms needed in higher education is to improve teaching and evaluation. The existing conditions in this regard are extremely unhappy. Most of the teaching, till comparatively recently, has been dominated by a syllabus which is many years out-of-date. In fact, the position in many universities remains unchanged still. As the performance of students is assessed by a single external examination based on the syllabus, an undue emphasis is placed on unintelligent and selective cramming. The situation is further aggravated by rigid rules which govern the selection of courses, by the inordinate amount of time that both students and teachers spend in formal classroom contacts, with the resulting lack of opportunity for independent study by the students and of adequate time for lecture-preparation by the teachers. If university teaching is to be vitalized, changes are needed on the following lines:¹³²

- more flexibility in the courses offered and more freedom of choice by the students;
- a marked reduction in the amount of formal instruction and a corresponding increase in tutorial work, discussion groups, seminars and in independent study; and
- a change in the character of teaching to discourage cramming drastically and to stimulate curiosity, problem-solving ability and originality.

11.43 The problem of introducing greater flexibility in the courses will be discussed in the next chapter. With regard to the formal lectures, we suggest that, in the universities and the colleges, the number of

¹³² The need to orientate university teachers to new and better methods of teaching has already been dealt with in Vol. I, Chapter IV.

formal classroom and laboratory hours should be somewhat reduced. The time thus saved should be devoted to independent study, under the guidance of instructors, to assigned reading, writing of essays, solving of scientific and mathematical problems, and small research projects in which the student seeks out and learns to use independently the books and documents he needs. Every effort should be made to challenge and stretch the minds of the students by assigning them more exacting reading assignments, asking them to solve more difficult problems and providing opportunities for independent study of subjects in which they become especially interested. In addition, the students should be encouraged to do much more general reading than they do at present, both during the academic year and in vacation periods. This highlights the importance of building up good libraries, both in universities and in colleges.

11.44 *Development of Libraries.* With ever-increasing enrolment in universities and colleges, the demand for library service has been constantly growing. Unlike in the past, the library staff have now to cater to the diverse needs of undergraduates, postgraduates and research scholars. It should be realized that modern university libraries are also required to serve a larger number of academic departments and to perform new functions like indexing and abstracting. Moreover, the present position of expenditure on books and periodicals is not satisfactory. It is only in four universities that expenditure on books and periodicals is more than 5 per cent of the total expenditure as shown below:

TABLE 11.1 PERCENTAGE EXPENDITURE ON BOOKS AND PERIODICALS IN UNIVERSITIES

Percentage of total expenditure	No. of universities ¹³³
Less than 1 per cent	5
1 to 5 " "	34
5 per cent and above	4

11.45 In this connection, we make the following recommendations:

- (1) The Heads of Departments and library staff should cooperate fully in drawing up an integrated plan of library development, from a long-range point of view. Such a plan should take into consideration a number of factors such as the anticipated increase in enrolment, the faculty-wise distribution of students, new subjects and fields of specialization, special research projects, and so on.

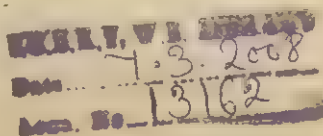
¹³³ Information available for 43 universities.

- (2) No new university, college or department should be set up without taking into account its library needs in terms of staff, books, journals, space, etc. Nothing could be more damaging to a growing department than to neglect its library or to give it a low priority. On the contrary, the library should be an important centre of attraction on the college or university campus.
- (3) The utilization of library grants should be suitably phased over a plan period. In other words, there should be a regular programme of strengthening of academic departments and the library, instead of haphazardly overfeeding them in one year and starving them in the next.
- (4) An essential thing about the development plan of a university library is to lay down physical rather than financial targets. Even more important is a proper use of books by students and teachers. Lectures should be supplemented by tutorial instruction, and thereafter the students should turn to the library to find for themselves, with the help of reference librarians, the relevant material and knowledge needed. More working hours and working days, easy accessibility to books, adequate provision in terms of staff, multiple copies of textbooks which may be loaned to needy students, better display of new reading material, organization of book-clubs, separate rooms for periodicals, reference books and research works, are some of the measures that would help raise the standard of library service. The reading habit, which is appallingly low, must be toned up in every possible way.
- (5) In addition to having 'departmental' and 'seminar' libraries stocked with a 'working collection of books and journals' the central library should facilitate interdisciplinary communication as also the work of research scholars in borderline disciplines. This will also be economical in the long run.
- (6) With the emergence of active research in our universities, there is a need for conservation of research potential through documentation work and service. It is, therefore, necessary to appoint a team of documentalists in university libraries who can speak the language of research workers and undertake the work of documentation-search, indexing and abstracting. For this purpose, it will be advisable to set up a few regional centres with equipment for photographic reproduction of documents such as microfilming and photostating.
- (7) We should completely break away from the traditional view that a library is a conventional but more or less useless accessory.

No definite set of standards can be used in developing a university library programme but the essentials relate to competent staff, an adequate collection of carefully selected and well-organized books, well-planned physical facilities and professors-teachers who teach with books.

- (8) A collection of books, even a collection of good books, does not constitute a 'library'. Given enthusiastic teachers 'who teach with books', and librarians who can cooperate with them in converting the library into an intellectual workshop, even a comparatively small collection of sensitively chosen books may work wonders in the life of students. Without such a staff, the most luxurious building or extensive book collection, may have no effect at all. The object of library planning is not to build a collection of books unrelated to class-work, laboratory research and conference room. The object is rather to relate book selection, organization of the books, conditions of access and all library activities to the daily needs and activities of the academic community, both professors and students. The book selection should be oriented toward supporting instruction and research. The teaching and library staff should determine the titles and copies of books to be purchased and periodically work together to discard obsolete books. Many of these can be replaced with microfilms and micro-cards.
- (9) The library should
- provide resources necessary for research in fields of special interest to the university;
 - aid the university teacher in keeping abreast of development in his field;
 - provide library facilities and services necessary for the success of all formal programmes of instruction;
 - open the door to the wide world of books that lie beyond the borders of one's own field of specialization; and
 - to bring books, students and scholars together under conditions which encourage reading for pleasure, self-discovery, personal growth and the sharpening of intellectual curiosity.
- (10) There is no formula for estimating with precision how much money a university should invest in its libraries.¹³⁴ It has been

¹³⁴ The total annual world book production during the years 1960-63 was of the order of 360,000, 375,000, 385,000, and 400,000 titles respectively. In 1966 it is expected to reach 450,000. Of these about 18 per cent are in English. This would mean about 80,000 titles covering all branches of learning are produced annually. Even if we were to import 15 per cent of the total titles for use by our universities and colleges, it would mean importing 12,000 titles. At an average cost of Rs. 20 per title and 250 multiple copies, the estimated expenditure would come to Rs. 48 million, and providing Rs. 2 million for books in all other languages, the expenditure on imported books alone would need Rs. 50 million annually.



found that the expenditure on library in relation to total educational expenditure of the university, has gone up from 1.88 per cent in 1951-52 to 4.04 per cent in 1960-61, by which time the grants provided by the UGC had begun to make an impact. The University Education Commission had suggested about 6.5 per cent of educational budget as reasonable expenditure on libraries. But this could vary, say, from 6.5 per cent to 10 per cent depending on the stage of development of each university library. It may also be suggested that, as a norm, a university should spend each year about Rs. 25 for each student registered and Rs. 30 per teacher.

- (11) The foreign exchange needed for university and college libraries should be allocated separately to the UGC.

11.46 It is most important to emphasize original thinking in the study of all subjects and to discourage memorizing. The rate of growth of knowledge is now so great that only a few of the so-called facts which one learns in the university are liable to be useful, or even true, a few years later. This is specially true of the sciences. Till comparatively recently, it was possible for a teacher to provide his students with a map, as it were, which would guide them through life. Now, the best thing he can do is to give them a compass. The function of a modern university is to give that enduring knowledge of the fundamental principles of a subject which would help them to solve new problems as they arise and to keep on learning throughout life. This should be regarded as the distinguishing mark of a 'university mind'.

11.47 There is a practice to assign the youngest, least experienced staff members to teach undergraduate classes. Some of them have neither the stature nor the experience nor the poise to win young men and women effectively to the pursuit of knowledge. In a way, effective teaching at this level demands the attention and cooperation of the best teachers available. This does not, of course, mean that there is a possibility of all or many senior and experienced teachers being given undergraduate work. But it does mean that there should be a possibility of undergraduates coming into occasional contact with such teachers, particularly when a new subject has to be introduced for the first time.

11.48 We would like to make the following suggestions for improvement of teaching:

- (1) A class hour at the university stage should not be less than 60 minutes. A part of the time, say 10 minutes, should be devoted to answering questions by students and assigning them homework. The content and quality of lectures in general needs to be considerably improved. One way of characterizing the level of class

work is that every one hour of instruction should receive about 3-4 hours of study time to digest the lectures.

- (2) In several cases, teachers are away, for long periods, from their institutions during term time. This interferes with the smooth working of the institutions and is detrimental to good teaching. It may be laid down as a rule that no teacher should be away from his institution during 'term time' for more than seven days in a year. There should also be a convention that during 'term time' teachers should not take up assignments which interfere with their teaching duties.
- (3) All new appointments should be made during summer time so that teachers join their new posts at the beginning of the academic year. Further, unless there be compelling reasons, no teacher should be permitted to leave an institution to take up another appointment during term time.

11.49 We realize that it would be impossible to bring these changes in all the institutions at the same time. They would become possible as better teachers and facilities become available. Most of them are relatively easy to introduce in the universities and their constituent colleges, but more difficult in the affiliated colleges, especially in the small colleges in the rural areas. But this is definitely the direction in which we should move.

11.50 *Experimentation.* We should like to draw attention pointedly to the need for experimentation, which we have stressed in other spheres of education also. There is immense scope for it in our educational system but unfortunately there is little deliberate and sustained effort in this direction. It is necessary both to create the desire and the will for it and to provide the financial and academic means to do so. There are two important areas in which such experimentation would yield particularly rich dividends.

- (1) One such area concerns the manner of handling larger numbers of students without a proportionate increase in educational expenditure or the number of faculty members. It is by no means clear that a small-sized student body necessarily leads to an improvement in standards or that there is some magically correct student-teacher ratio. Some subjects can be taught as well in large classes as in small ones. There is evidence to show that classes of intermediate size, say 40 to 80, have little or no advantage over classes of several hundred students. The use of microphones and tape records of lectures by distinguished professors from all over India could be usefully tried for this purpose. Many leaders in higher education have come to the view that part of college

teaching should be done in large classes and part in small groups of 5 to 20 students, with at least half the student's time being spent on assigned reading, problem-solving, and other kinds of independent study. We should also remember that the students usually learn almost as much from each other as from the faculty.

- (2) Another desirable experiment would be to have a certain amount of the teaching at the undergraduate stage done by the postgraduate students after their first year. This would have three advantages: the student-teachers would gain valuable experience in teaching, and their ability as teachers could be judged before they are appointed to college or university faculties; the number of teachers at the college level could be increased or, alternatively, part of the time of lecturers and readers could be freed for research. It would also be possible to pay postgraduate and research students for teaching tasks and this would help some needy and able students to continue their education.

11.51 *Teaching Methods.* The problem of teaching methods in higher education has been a relatively neglected subject in India so far. We recommend that it may be examined by the UGC through a special committee appointed for the purpose. We also recommend that the schools of education,¹³⁵ whose establishment we have proposed, should make a special study of the teaching methods, not only at the school stage, but also in the universities and affiliated colleges. Such studies will be of great use in organizing the orientation courses for junior lecturers which we have recommended.

11.52 *Examination Reform.* In the present system, when the future of the students is totally decided by one external examination at the end of the year, they pay minimum attention to the teachers, do little independent study throughout most of the academic year and cram desperately for the final examination. The crippling effect of external examinations on the quality of work in higher education is so great that examination reform has become crucial to all progress and has to go hand in hand with improvements in teaching. The UGC rightly emphasized the significance of the problem and said: 'We are convinced that if we are to suggest any single reform in university education, it should be that of examinations.' One of the earliest efforts of the UGC was concerned with the study of the problem and the report of its expert committee on examination reform is a useful document. But it has not been implemented to any appreciable extent so far. This is one of those areas in education about which one can say that the problem is known, its

¹³⁵ Vol. I, Chapter IV.

significance is realized, the broad lines of the solution—at least to begin with—are known; but for some reason or other, an effort to implement it on any worthwhile scale or in a meaningful manner has not yet been made. What is needed is vigorous and sustained action.

11.53 We make below a few recommendations that might make a welcome break-through in the situation. One line of attack would be to abolish set syllabuses and the external examinations based on them altogether and to replace them by a system of internal and continuous evaluation by the teachers themselves. This is already being done in some institutions like the IITs or the agricultural universities and it could be increasingly extended to others as soon as the necessary facilities and conditions can be provided. We hope that, at no distant date, it will be adopted by all teaching universities and that the major universities would give a lead in this matter.

11.54 We realize, however, that external examinations will remain with us for a long time, especially in universities which have large numbers of affiliated colleges of very unequal standards. The main strategy here would be to attack the problem on two fronts: introduction of more frequent, periodical assessment so that the undue emphasis on the final examination as the sole determinant of success is reduced; and reform of evaluation techniques. With regard to the first, a good deal can be gained if the performance of the student is assessed throughout the session in a suitable manner and if periodical tests are held in the middle and at the end of each term. A system of internal assessment should be introduced as a supplement to the external examination, based on such periodical evaluations. The results of these internal assessments should not be mechanically added to the external marks but kept separate and both should be shown side by side in the final certificate. Passes should be required separately in both and the divisions gained in them should be declared separately. Every year, a careful review should be made of the correlation between internal and external assessment separately for each institution. This should be taken as a point for classification of colleges and also related to grant-in-aid so that institutions which tend to overassess their students persistently would stand to lose in status and finance. The regulations may also authorize the university to withdraw affiliation for persistent irresponsible assessment.

11.55 Regarding improvement in examination techniques, we have little to add to the learned literature already available on the subject. As we said earlier, what is lacking is not knowledge, but will, courage and perseverance to work out its implementation. We suggest the following measures:

- (1) There is need for a central source to guide and activate a movement of examination reform, without which no early and effective

tive progress is possible. For instance, the activity that one now sees in this matter in the State Boards for Secondary Education is due largely to the Central Examination Reform Unit in the National Council of Educational Research and Training. We recommend that the UGC should set up immediately a similar examination reform unit for higher education at a sufficiently high level which would work in collaboration with the universities. This could become the starting point of an effective programme of reform.

- (2) The next step should be to persuade some universities to launch upon the programme in a big way. In addition to major universities which will have to give a lead by abolishing the external examinations altogether, the other universities should set up special units for examination reform and should prepare and implement a programme of reform in consultation with the central unit.
- (3) Another important point of emphasis would be the reorientation of university teachers to adopt new and improved techniques of evaluation. A programme of seminars, discussions or workshops should be organized to serve as the spearhead of the reform. This will have to be continued from year to year to evaluate results, to try out experiments and to make further plans. This would be the responsibility of the central and local examination reform units.

We trust that, if a few universities can make a determined attack on the problem and achieve a break-through, the whole programme of examination reform will be greatly accelerated.

11.56 We recommend that the grading or classification of examination results is almost invariably done on an absolute rather than on a relative basis. In our present system of examinations, an 80 per cent mark, say, in mathematics, does not convey the same meaning as, say, 80 per cent mark in history or English. Again, an 80 per cent mark in one year does not mean the same thing as 80 per cent mark in another year because examiners may be different, and there may be many other variations from year to year. A system of grading must be such as to bring out whether a student belongs, say, to the top 20 per cent of his class or to the bottom 20 per cent. It is strongly recommended that even if the present system of examinations and classifying the results is continued, it should be supplemented by giving, in the same certificate, the relative grading of the student, say on a five point scale. Grade 'A' would mean that the student is in the top 20 per cent of those who have been successful at the examination.

11.57 We recommend that early measures should be taken to abolish payment of remuneration to examiners. Evaluation is a part of teaching and teachers should be willing to undertake it as part of their duties. This is one of the reasons why we have recommended an increase in the salary scales of teachers. However, we recognize that the load of this work should not be too heavy on any teacher and would, therefore, suggest that the maximum number of scripts to be examined by a teacher in a year should not exceed 500.

11.58 *The Medium of Education.* The problem of teaching and evaluation in higher education is inextricably linked with the medium of education and examination. It was pointed out earlier¹³⁶ that, as a part of the development of education in our country, we have to move energetically in the direction of adopting the regional languages as media of education at the university stage, that careful preparation should be made for the purpose, that both the manner and the time of transition would have to be left for decision to the university system. We shall now deal with some other aspects of the problem from the point of view of practical implementation:

- (1) We would like to emphasize that the medium of classroom communication and examination should generally be the same. The present arrangement under which a large proportion of students, at the first degree stage and even later, use the regional language for purposes of examinations although the classroom instruction is given through the medium of English, is educationally unsatisfactory. If the student can be expected to express himself in the regional language in his examination, it should not normally be difficult for a teacher to do the same in the classroom. In fact, the student's understanding of the fundamental problems and issues would be better and his performance in the examination would improve if, in all cases where the universities have taken a decision to adopt the regional languages as media of examinations, they also decide to adopt them as normal media of classroom communication. However, it must be remembered that the hold of English as a medium in the universities is linked with the use of the regional languages as the languages of administration in the States. So long as the prize posts in administration go to students who have good command over English, it will not be surprising if a substantial proportion of students continue to prefer education given through it.
- (2) While the goal is to adopt the regional languages as media of

education, we should like to stress again that this does not involve elimination of English. In fact, English, as an important 'library language' would play a vital role in higher education. No student should be considered as qualified for a degree, in particular, a Master's degree, unless he has acquired a reasonable proficiency in English (or in some other library language). The implications of this are twofold: all teachers in higher education should be essentially bilingual in the sense that they would be able to teach in the regional language and in English, and all students (and, particularly postgraduate students) should be able to follow lectures and use reading materials in the regional language, as well as in English.

- (3) Great care has to be taken to ensure that the progress of the student entering the university is hampered as little as possible by complexities relating to the media of education. In a student's life, the change from school to college is a crucial stage. On entering college, he finds that there is a greater demand on his powers of understanding and concentration than at school. When to this is added the difficulty inherent in a sudden change in the medium of education, it is not to be wondered at that many students feel bewildered and lost and lose zest in their studies. At the earlier stage of the undergraduate course, it will be an advantage if the bulk of the classwork is done through the regional language. As one goes higher up the educational ladder and as the student's command over English and his familiarity with its use as a medium of education increases, more and more of the class-work could be in English. At the postgraduate stage, at least for some time to come, the bulk of the class-work will have to be in English.
- (4) To safeguard the interest of minorities, some special steps would be needed. The maintenance of colleges teaching through the medium of Hindi in the non-Hindi speaking areas or of Urdu (which is not a regional language in the sense the other modern Indian languages are) in any part of the country should not only be permitted but encouraged. In so far as colleges teaching through the media of modern Indian languages other than the regional language of the area are concerned, there need be no obligation on the State to provide such institutions, except in cases where an adequate number of students is available. But if any linguistic minority group offers to maintain such an institution, it should be permitted and admissible grants given to it.
- (5) As we have recommended earlier, it would be desirable to establish centres of advanced study for the development of modern Indian languages so as to make them fit media for higher educa-

tion. These should include two centres for Urdu—one in the North and one in the South.

11.59 We are definitely of the view that at the university stage, no language should be made a compulsory subject of study but the classical and modern languages of India and important foreign languages should be provided as elective subjects. As we have recommended elsewhere,¹⁸⁷ there should be considerable flexibility with regard to the choice of the subjects. The compulsory study of a language is likely to make some useful combination of subjects impracticable by placing too heavy a burden on the students. We were concerned to find that in one big university, about 50 per cent of the total time available for education at the undergraduate stage was devoted to the study of languages only. It is obvious that, under such conditions, the studies of the principal subjects greatly suffer and standards remain low.

11.60 Since an adequate command over a library language is indispensable for a university student, we recommend that adequate facilities should be provided in universities and colleges for the study of English and where necessary or possible, for other library languages also. For this purpose, we recommend the following:

- (1) Special units for teaching English should be established in university and colleges whose main objective would be to give a good working knowledge of English to new entrants by the adoption of modern teaching techniques and in as short a time as possible. A distinction has to be made between the teaching of English as a skill and the teaching of English literature. The teachers in this unit will, therefore, need special training on the lines of the pioneer work being done at the Central Institute of English at Hyderabad. Moreover, it has to be noted that the students who enter the universities will be at different levels of attainment in English. Some will have come from English-medium schools and be well advanced. Others who come from urban schools with, comparatively speaking, good facilities for teaching English would be at an average level. But a large number who would have come from rural areas or the weaker schools will be at a much lower level of attainment. No single course in English would meet the needs of all these students. It should, therefore, be a responsibility of the English units to adjust their teaching to the needs of the different categories of students and to ensure that they are all given at least that essential command over the language which will enable them to use it efficiently as a library language. While the facilities should be provided in all institutions so far as possible, it should be optional for each student

to decide the course he would take to meet his needs or even take no course at all, if his preparation at school stage is found to be adequate.

- (2) It would be an advantage to teach some English as a part of the elective subject course in the first year of the undergraduate stage. For example, students of economics may study English for about two periods a week as a part of their course in the first year. The object of this teaching would be to introduce the students to literature in economics in English, to the special vocabulary used in the subject and to help them to read with comprehension books and journals in English in their special field. Where such courses have been tried, they have proved quite helpful and have enabled the student to use English as a library language in his own field far more efficiently than a general English course would do.
- (3) While English is our most important library language, it is necessary, as we have repeatedly stressed in this report, to develop other important library languages also. Much greater attention should, therefore, be given to the teaching of library languages other than English than is the case at present. In particular, we stress the immediate need to study Russian on a larger scale.

11.61 In major universities, it will be necessary, as a rule, to adopt English as the medium of education because their students and teachers will be drawn on an all-India basis. This is the only feasible approach if their all-India character is to be maintained. But we are not opposed to the possibility of some university, which has the necessary quality of staff and students, trying this experiment in a regional language. We realize that this will involve some difficulties in drawing their students and teachers on an all-India basis; but we are convinced that they can be overcome. The position can be reviewed in due course as the linguistic situation develops.

STUDENT SERVICES

11.62 A major weakness of the existing system of education is the failure to provide adequately for student welfare. This is an aspect of higher education which needs to be improved on a priority basis.

11.63 Student services are not merely a welfare activity but constitute an integral part of education. The following are some of the important services which can be included in this programme:

- orientation for new students;
- health services;
- residential facilities;

- guidance and counselling including vocational placement;
- student activities; and
- financial aid.

Financial aid in the form of scholarships, book-banks and textbook loans and the provision for students to earn while they learn have been discussed elsewhere in the Report.¹²⁸ In this chapter, it is proposed to discuss briefly the other forms of student services.

11.64 Orientation for New Students. Entry into a college or a university is a very important change in the life of a student, and in some cases, the change is so great and sudden that he is apt to lose his balance. Some deliberate steps have therefore to be taken to facilitate adjustment. We recommend that all institutions of higher education should organize orientation programmes for their new students in the beginning of the academic year. Senior students should be actively associated with this programme. Group discussions and individual conferences can be arranged for the purpose and, where necessary, guided campus tours will also be helpful. No student should be left in doubt about the arrangements for housing and food, days and hours when his classes meet, the fees to be paid and above all the general traditions of the institutions and the rules and regulations he is expected to observe. Each student should also be assigned to an academic adviser, who should be a member of the staff and assist him in planning and formulating his total college programmes and organizing his studies to the best advantage. Every member of the teaching faculty should be expected to serve as an academic adviser to a group of students.

11.65 Health Services. Health services for students are generally neglected. The replies to the questionnaire sent by the Education Commission to the different universities on the subject have revealed that few of them have conducted any health surveys of their students and not many have organized systematic programmes of health services for them. In a number of universities, there is no medical examination, even at the first entry stage, and where medical examinations have been conducted, they are often of a perfunctory character without any suitable follow-up work. Society has a special stake in the health and the physical well-being of university students who are (or should be!) the elect of the rising generation and in whom it has to invest large resources and to whom it looks for the advancement of national interests. The organization of student health services at the university stage, therefore, should receive a high priority.

¹²⁸ Vol. I, Chapter VI.

11.66 We recommend that early steps should be taken to organize adequate health services in universities and colleges. Health centres should be established on every university campus and in townships with a large student population to provide for medical examination, follow-up treatment, and emergency care. The services of part-time doctors should be enlisted for the purpose in smaller *mofussil* towns. We also recommend that adequate provision should be made for health education of students and for securing their involvement in the organization of health services—both in policy-making and in the execution of programmes. The UGC may explore the possibility of organizing health services for university teachers and students on the lines of the contributory health service organized for the employees of the Government of India. A beginning may be made with one or two universities with a large resident student population and, in the light of the experience gained, the programme may be extended to other centres.

11.67 *Hostels and Day-Study Centres.* At present, hostel facilities have been provided for about 18 per cent of the enrolment at the university stage. There is need to expand these considerably and we suggest that an effort should be made to provide hostel accommodation for about 25 per cent of the enrolment at the undergraduate stage and 50 per cent of the enrolment at the postgraduate stage. In professional courses like agriculture, engineering or medicine, the extent of hostel facilities provided is already fairly high. We do not share the view that all students in these courses should be necessarily provided with hostel facilities. In our opinion, it is necessary to emphasize the provision of hostel facilities for the courses in arts and science, at least for the immediate future. In order to cut down the costs of this programme, it would be necessary to keep the design of the hostels as simple as possible. Moreover, the running costs should be kept down to the minimum and there should be provision for a good deal of self-help by the students.

11.68 For the use of non-resident students who do not have adequate facilities at home—the number of such students is extremely large in the towns and cities—day-study centres and library seats should be provided on a liberal scale. The target to be aimed at should be to provide day-study centres for about 25 per cent of the non-resident students. These should also have subsidized or low-cost cafeterias working on the principle of self-service.

• 11.69 *Guidance and Counselling.* A guidance and counselling programme which would assist the students in the choice of courses, indicate the lines of remedial action and help in dealing with emotional and psychological problems should be an integral part of the educational

facilities provided in institutions of higher education. For an effective guidance service, it would be necessary to have at least one counsellor for every one thousand students on the roll. Smaller institutions may share a counsellor who will work in each of the institutions on a part-time basis. The organization of such a service will require a large number of professionally trained counsellors. We suggest that a project for their training should be organized in some university competent to do so.

11.70 The employment, information and guidance bureaux of the National Employment Service and the student advisory bureaux which have been existing in a number of universities have been doing useful work. The former have been collecting, compiling and making available to the students occupational and employment market information, information regarding preparation for different careers, training facilities, apprenticeships, scholarships, etc. They have also been placing students in employment. In the absence of counselling services with fully qualified counsellors, they have also been offering advice and help to the students in planning their careers. The student advisory bureaux were originally set up by the Ministry of Education to provide information regarding facilities for higher education abroad, but now also provide information regarding facilities in India. Since educational and occupational information is closely interlinked, it is recommended that these bureaux may be combined to form an information and employment centre which should function directly under the supervision of the dean of students.

11.71 *Student Activities.* It is necessary that the student's energies are channelled into meaningful and challenging pursuits. This would be partly achieved through intensification of curricular programmes to which we have already referred. But that is not enough. It is also necessary to develop a rich and varied programme of co-curricular activities, which would include lectures, debates, essay competitions, group discussions, cultural programmes and contests, study circles, social service camps, NCC, tours and excursions, sports and tournaments, publication of students' journals, educational film shows, conduct of student libraries, canteens and cooperative stores and welfare activities connected with financial and medical assistance to students. Many of these activities are even now a part of the programme in good institutions. They are rich in educational stimuli and help to develop and strengthen certain valuable attitudes and qualities such as cooperation, initiative, self-confidence and leadership. These should be organized not only during term time but also during vacations, which is more suited for some of the programmes.

11.72 *Administration of Welfare Services.* The advice, support and initiative of the vice-chancellor or principal are indispensable for an imaginative and effective programme of student welfare. But such work is so complex and many-sided that it needs a full-time dean of student welfare to look after its implementation. He should be an educationist with tact and vision trained specifically for the job and should be given sufficient status and authority to command respect and cooperation from the students and the staff. He should be expected to participate in academic work to the extent possible and regarded as a member of the academic community.

11.73 *Student Unions.* Student unions represent an important way of providing student participation in university life outside the classroom. Properly organized, they help in self-government and self-discipline, provide a healthy outlet for students' energies and give the students useful training in the use of democratic methods.

11.74 It is for each university to decide how its students' union will function and we would welcome a good deal of experimentation. But some broad principles can be indicated.

(1) Membership of the student unions should be automatic in the sense that every student should be presumed to be its member. But every student should be expected to choose at least one activity organized in the institution, e.g., arts society, football club, drama association, etc., and pay the required subscription. There should be no separate payment for the membership of the students' union as such. Each of the activities will thus have funds of its own and these would be handled by appropriate committees. The funds of the central union—to the extent they are needed—would be formed by contributions from each activity committee. The university or college should also give aid to the central union as well as to the different activities.

(2) It may be desirable to elect the office-bearers, not directly by the large body of students (many of whom are fresh men), but indirectly by the different students' societies in the university who would send selected representatives to the union executive.

(3) There should be some disqualifications for office-bearers. For instance, persons who have spent two or more years in the same class should be disqualified.

(4) The successful working of student unions depends to a large extent upon the mutual trust and confidence between the teachers and the students. Greater teacher involvement in union activities should, therefore, be ensured. We would strongly commend the establishment of a university or college union in which all teachers and students automatically become members. All committees of the union and vari-

ous activity groups should have teachers on them and it should be their responsibility to guide the students tactfully on right lines without curbing their freedom to decide for themselves.

11.75 In some of the institutions, the educational objectives of student unions are being well realized and they are functioning satisfactorily. But in a majority of institutions, and particularly in recent years, they have tended to function like trade unions presuming to represent students' interests *against* those of the teachers and authorities. This idea should be firmly and definitely discouraged. A university or college is an academic fellowship of equals where things can be discussed and decided reasonably, and the joint committees of teachers and students which we have recommended have this purpose specifically in view. These should be fully utilized to ascertain and redress the genuine difficulties of students. There is a general and, perhaps on the whole justified, complaint on the part of students that the college or university authorities sometimes take no notice of these difficulties and deprivations till they are backed by some form of so-called 'direct action' which has really no place in an educational institution. When, however, they are confronted by a strike or demonstration or some kind of violence, they sometimes yield abjectly and students get the unfortunate impression that it pays to break the rules of discipline and good conduct. There is no justification for such administration. The members of the staff, the principals and vice-chancellors should all learn to be sympathetic, understanding, responsive and reasonable and yet decisive and firm, when necessary, in their dealings with students. What binds together students and teachers in a deep and creative partnership is the sharing of common interests, mutual regard and sense of values, and working together for their main purpose which is the pursuit of knowledge and discovery. Anyone who is not committed to this philosophy or prepared to honour it has really no place in an institution of higher education.

11.76 It would be useful to convene a conference of representatives of the students' unions in universities and colleges once a year, for the purpose of considering various problems of common interest such as the improvement of discipline and the promotion of academic excellence. Such a conference could also promote a sense of participation in the student community in the development of universities and colleges, apart from affording them an opportunity to express their views on matters that concern their studies and well-being. We suggest that the UGC should take initiative in convening and financially supporting such an annual meeting.

11.77 *Student Discipline.* In the last couple of decades, so much has

been written about problems of student unrest, its numerous ugly manifestations and the causes responsible for it that it is not necessary for us to repeat the details. Briefly, there have been many ugly strikes and demonstrations—often without any justification—leading to violence, walk-out from classrooms and examination halls, ticketless travel, clashes with the police, burning of buses and cinema houses and, sometimes, even manhandling of teachers and university officers. There is a variety of causes which has brought about these ugly expressions of uncivilized behaviour, e.g., the uncertain future facing educated young men leading to a sense of frustration which breeds irresponsibility; the mechanical and unsatisfactory nature of many curricular programmes; the totally inadequate facilities for teaching and learning in the large bulk of institutions; the poor student-teacher contact—many a student goes through the entire undergraduate course without exchanging a word with his teachers; the inefficiency and lack of scholarship on the part of many teachers and their failure to interest themselves in the students' problems; the absence of imagination and tact combined with firmness on the part of heads of institutions; the prevalence of what has come to be known as teacher politics in some colleges and universities, the attempt by political parties to interfere in their work, and by no means the least, the impact of the conditions of public life in the country, the falling standards of discipline among the adults and a weakening of their civic consciousness and integrity.

11.78 While such incidents and their contributory factors have been a feature of higher education for some years past, what is particularly disturbing at present is the noticeable trend towards a progressive deterioration and the fact that these acts are increasingly committed quite unapologetically and on irrelevant and frivolous grounds. This is specially regrettable in view of the considerable expansion of opportunities for youth that independence has initiated and of the critical challenges that the nation is facing in the fields of both defence and economic and cultural development. In such a situation, sociological explanations are not enough. Indeed, unless they indicate a feasible solution of the problem and lead to effective action, mere explanation is likely to be mistaken for justification. Urgent steps are, therefore, needed to curb these trends and to ensure that, whatever else education may or may not aim at doing, it should at least strive to enable young men and women to learn and practise civilized norms of behaviour and commit themselves honestly to social values of significance. It is also necessary to remember that the responsibility for the situation is not unilateral—it is not merely that of the students or parents or teachers or State Governments or the political parties—but multilateral. All of them share it, together with many factors in the objective

situation and no effective solution is possible unless each agency responsible for the malaise does its own duty. Some of the remedies for students' unrest, therefore, go beyond the education system. But even if we leave them out, there are two major things that the education system itself can and must do:

- remove the educational deficiencies that contribute to it; and
- set up an adequate consultative and administrative machinery to prevent the occurrence of such incidents.

11.79 The first of these measures, the improvement of the educational process, is the heart of the problem. The discipline which higher education cultivates should aim at self-discipline—discipline directed from within, which does not depend primarily on external control. Moreover, such discipline can grow only if it is deeply related to the pursuit of deeper goals in life and rises out of interest and devotion to scholarship. In other words, the incentives to positive discipline have to come from the opportunities that the institution presents and the intellectual and social demands it makes on the students. From this point of view, we have emphasized, throughout this Report, the need to improve standards in institutions at all stages of education, including colleges and universities. We have also stressed the need, side by side, for providing a better standard of student services. Unless this is done, a radical cure to the problem is not possible.

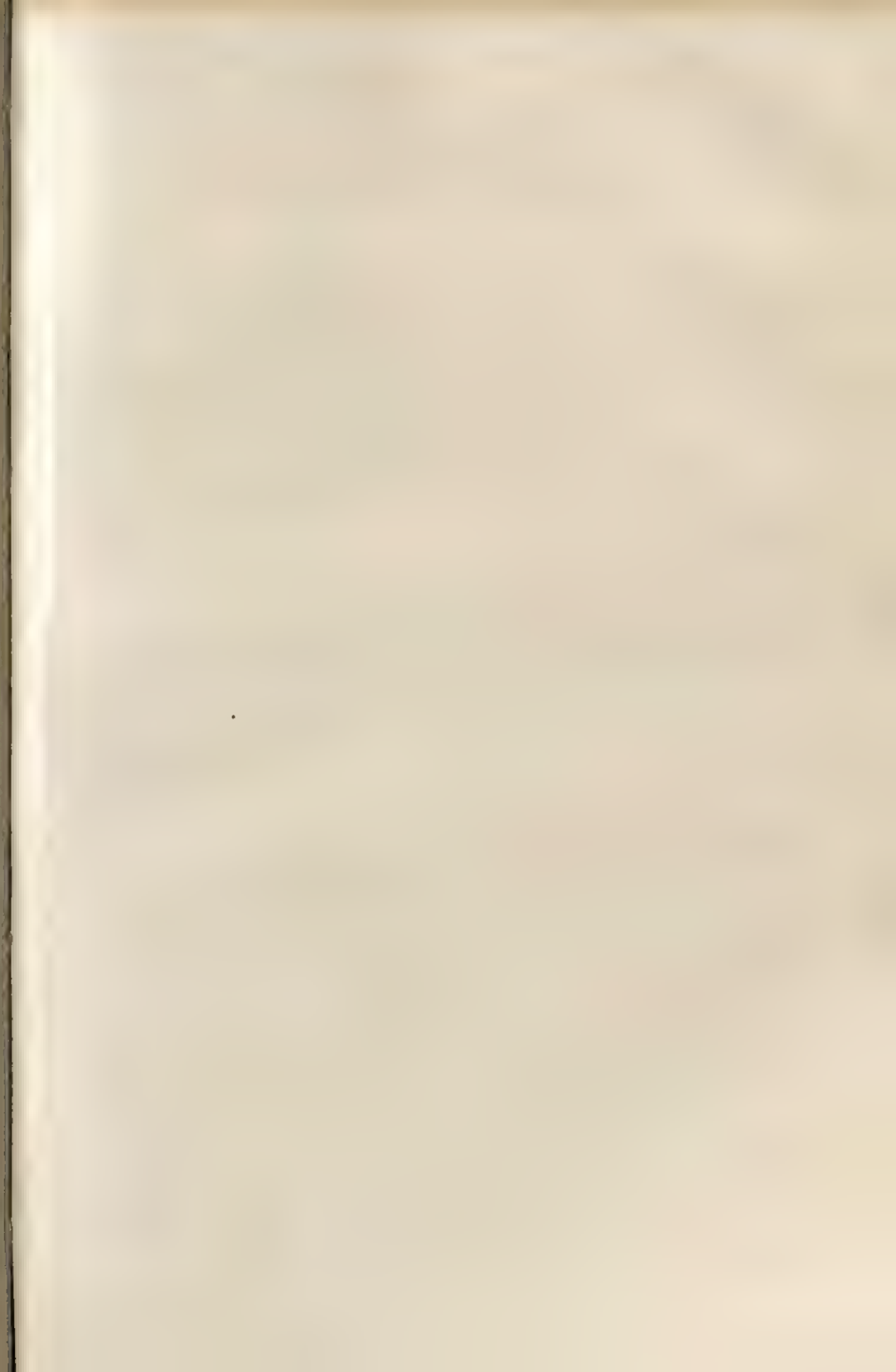
11.80 With regard to the second of these measures, we would like to emphasize that the whole of university life is to be treated as one and that all attempts at polarisation between teachers, students and administration should, therefore, be avoided. From this point of view we have made a number of important recommendations such as the appointment of joint committees of teachers and students, the establishment of a central committee under the chairmanship of the vice-chancellor or principal consisting of students and teachers, and where advisable, the association of students with the Academic Council and the Court. What we have to strive to generate is a spirit of comradeship between teachers and students based on mutual affection and esteem and on a common allegiance to the pursuit of truth, of excellence in many directions and of the good of the society as a whole. If this spirit could be created, many of the problems of discipline which bedevil our academic life at present will become easier to solve and, will, we hope, disappear in course of time.

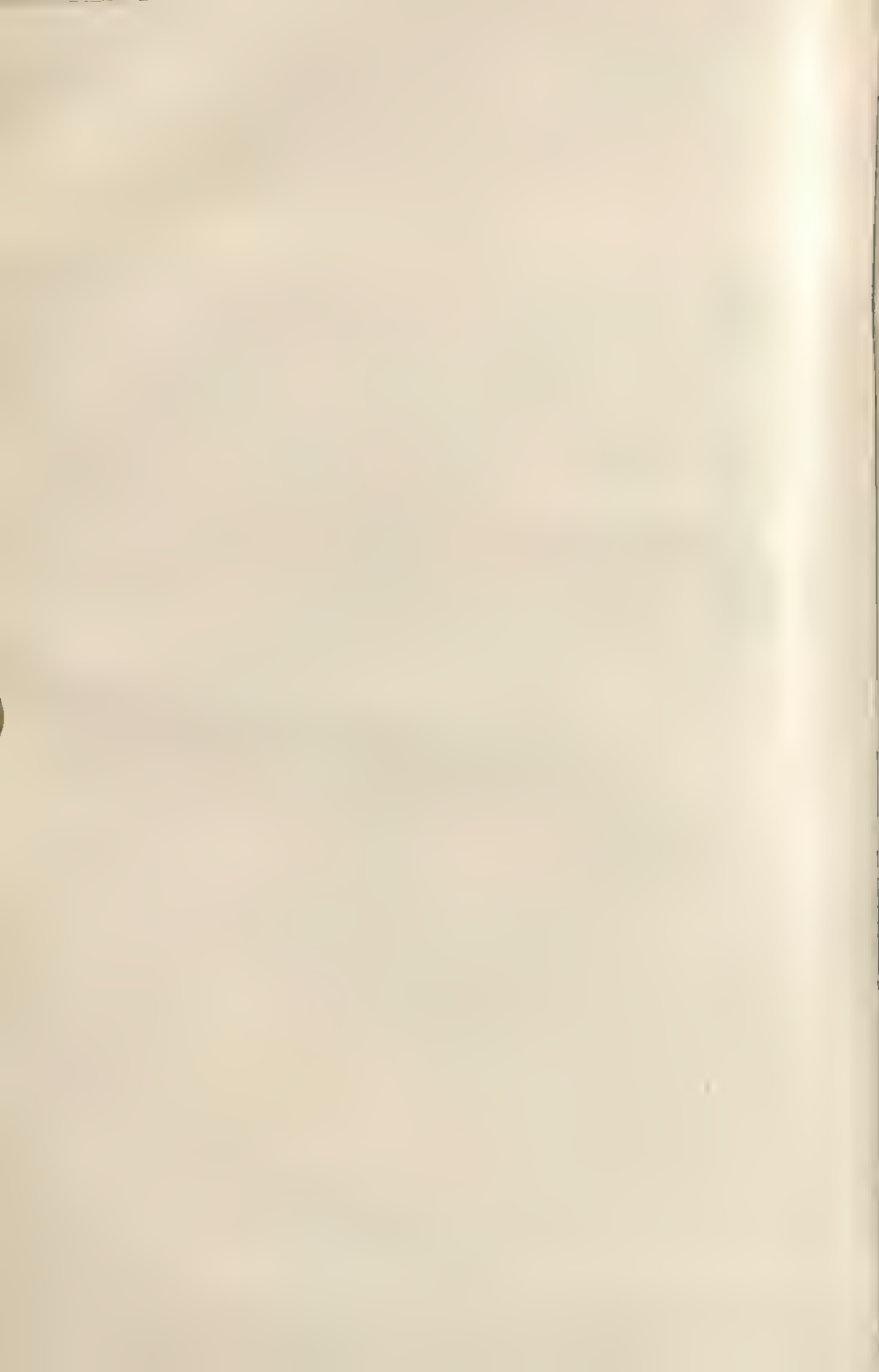
NOTE

11.81 Universities and Colleges

There has been since Independence, a large expansion in the field of higher education. The number of universities has increased from 20 in 1947 to 64 in 1966. There are now institutions 'deemed to be universities' under Section 3 of the UGC Act. The number of affiliated/university colleges was 2,565 in 1965-66. A list of universities, 'institutions deemed to be universities' and the number of university/affiliated colleges of each university is given below:

Year of Establishment	University/Institution Deemed to be University	Number of Colleges
A. Universities		
1857	Calcutta University	168
	Bombay University	58
	Madras University	157
1887	Allahabad University	6
1916	Banaras Hindu University (Varanasi)	18
	Mysore University	63
1917	Patna University	10
1918	Osmania University (Hyderabad)	61
1921	Aligarh Muslim University	4
	Lucknow University	18
1922	Delhi University	41
1923	Nagpur University	84
1926	Andhra University (Waltair)	61
1927	Agra University	143
1929	Annamalai University (Annamalainagar) . . . . .	..
1937	Kerala University (Trivandrum)	140
1943	Utkal University (Bhubaneswar)	72
1946	Saugar University	67
1947	Rajasthan University (Jaipur)	75
	Panjab University (Chandigarh)	149
1948	Gauhati University	75
	Jammu and Kashmir University (Srinagar)	34





Year of Establishment	University/Institution Deemed to be University	Number of Colleges
1949	Roorkee University . . . . .	..
	Poona University	46
	M.S. University of Baroda	6
	Karnatak University (Dharwar)	53
1950	Gujarat University (Ahmedabad)	125
1951	S.N.D.T. Women's University (Bombay)	17
	Visva-Bharati (Santiniketan)	8
1952	Bihar University (Muzaffarpur)	44
1954	Sri Venkateswara University (Tirupati)	28
1955	S.V. Vidyapith (Ballabh Vidyanagar)	13
	Jadavpur University (Jadavpur) . . . . .	..
1956	Kurukshetra University (Kurukshetra)	4
	Indira Kala Sangit Vishwavidyalaya (Khairagarh)	32
1957	Vikram University (Ujjain)	39
	Gorakhpur University	41
	Jabalpur University	21
1958	Varanaseya Sanskrit Vishvavidyalaya	75
	Marathwada University (Aurangabad)	28
1960	U.P. Agricultural University (Nainital)	4
	Burdwan University	43
	Kalyani University . . . . .	..
	Bhagalpur University	44
	Ranchi University	35
1961	K.S. Darbhanga Sanskrit Vishvavidyalaya	28
1962	Punjab Agricultural University (Ludhiana)	5
	Punjabi University (Patiala)	9
	Orissa University of Agriculture and Technology (Bhubaneswar)	3
	North Bengal University (Siliguri)	19
	Rabindra Bharati University (Calcutta)	20
	Magadh University (Gaya)	34
	Jodhpur University	2
	Udaipur University	11
	Shivaji University (Kolhapur)	51
1964	Indore University	17
	Jiwaji University (Gwalior)	30
	Ravi Shankar University (Raipur)	44
	University of Agricultural Sciences (Hebbal)	3
	Andhra Pradesh Agricultural University (Hyderabad)	6
	Bangalore University	31
	Jawaharlal Nehru Krishi Vishvavidyalaya (Jabalpur)	8
1965	Dibrugarh University	34
1966	Madurai University . . . . .	..
TOTAL (Colleges) .		2,565

Year of Establishment	University/Institution Deemed to be University	Number of Colleges
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B. Institutions deemed to be Universities under UGC Act

1958	Indian Institute of Science (Bangalore) Indian Agricultural Research Institute (New Delhi).	
1961	Indian School of International Studies (New Delhi).	
1962	Gurukul Kangri Vishwavidyalaya (Hardwar). Jamia Milia Islamia (New Delhi)	
1963	Gujarat Vidyapeeth (Ahmedabad), Kashi Vidyapeeth (Varanasi).	
1964	Tata Institute of Social Sciences (Bombay). Birla Institute of Technology and Science (Pilani).	

SUMMARY

1 *Objectives of Universities.* In broad terms, the functions of the universities in the modern world may be said to be the following:

- to seek and cultivate new knowledge, to engage vigorously and fearlessly in the pursuit of truth, and to interpret old knowledge and beliefs in the light of new needs and discoveries;
- to provide the right kind of leadership in all walks of life, to identify gifted youth and help them develop their potential to the full by cultivating physical fitness, developing the powers of the mind and cultivating right interests, attitudes and moral and intellectual values;
- to provide society with competent men and women trained in agriculture, arts, medicine, science and technology and various other professions, who will also be cultivated individuals, imbued with a sense of social purpose;
- to strive to promote equality and social justice and to reduce social and cultural differences through diffusion of education; and
- to foster in the teachers and students, and through them in society generally, the attitudes and values needed for developing the 'good life' in individuals and society.

11.02

2 In addition to these broad functions which they share in common with all universities, Indian universities will have to shoulder some special responsibilities in the present state of our social and educational development. For instance,

- they must learn to serve as the conscience of the nation; and from this point of view, they should encourage individuality, variety and dissent, within a climate of tolerance;
- they should develop programmes of adult education in a big way and to that end, evolve a widespread network of part-time and correspondence courses;
- they should assist the schools in their attempts at quantitative self-improvement;
- they should shake off the heavy load of their early tradition which gives a prominent place to examinations and strive to improve standards all-round by a symbiotic development of teaching and research; and
- they should create at least a few centres which would be comparable to those of their type in any other part of the world and thus help to bring back the 'centre of gravity' of Indian academic life within the country itself.

11.04-10

3 If these objectives are to be realized, we need a well-conceived and comprehensive plan for the development of higher education, spread over the next twenty years, which will include, among other things, the following three programmes of high priority:

- A radical improvement in the quality and standards of higher education and research;
- Expansion of higher education to meet the manpower needs of national development and, to some extent, the rising social ambitions and expectations of the people; and
- Improvement of university organization and administration.

11.11

4 *Major Universities.* The most important reform in higher education is the development of some 'major universities' where first-class postgraduate work and research would be possible and whose standards would be comparable to the best institutions of their type in any part of the world. The UGC should select, as soon as possible, from amongst the existing universities, about six universities (including one of the IITs and one Agricultural University) for development as major universities. The programme should begin in 1966-67.

5 A major university should have a 'critical mass' of students and teachers of outstanding capacity and promise. From this point of view,

- (1) each major university should be assigned a number of scholarships for the undergraduate stage which will provide it with enough talented students for its postgraduate classes. Of these scholarships, about half should be from outside the area of the university;
- (2) each department or faculty of a major university should have a specially appointed personnel advisory committee, which should work in close collaboration with the appointing authorities of the university. The search for staff, instead of being limited to the State or the region, should be made nation-wide and, in a sense, world-wide. Where necessary, the selected candidates should be offered advance increments. What is even more important, they should be assured of research opportunities, opportunities for study leave and the possibility to achieve professional excellence. There should be room for flexibility in the appointments and promotions. The UGC should place at the disposal of each university a contingency fund which may be used to provide more attractive salaries to persons of exceptional promise and performance.

6 It is necessary to establish 'clusters' of advanced centres in the major universities. They will add strength to, and enrich one another and be specially helpful in promoting interdisciplinary research. About fifty such centres should be established, including some in modern Indian languages over the next five to ten years. At least one of them should

concentrate on developing an interdisciplinary approach to education. Other important areas to be covered are agriculture, engineering and medicine.

(1) The administration of a centre, subject to the overall supervision of the university's Executive Council, should be the responsibility of its director assisted by a small but representative committee of his colleagues.

(2) The original selection of a university department as a centre should be made on the basis of the quality and extent of work already done by it, its reputation for good teaching, its contribution to research and its potentiality for further development. The process of selection should be so devised that it will win the confidence of the universities and the academic community generally.

(3) The privilege of being a centre of advanced study should be continually earned and deserved. Each centre of advanced study should have, say, once in three to five years, a visiting committee, consisting of outstanding Indian and, where possible and necessary, foreign experts who will conduct a review and appraisal of the accomplishments of the centre.

(4) The centres within a university should function in close collaboration with other centres and departments which are not centres of advanced study and measures should be adopted to involve the entire staff of the university in functioning as an intellectually effective community.

(5) The major universities should constantly strive to enlarge the area of their excellence. For this purpose, they might be given a grant in proportion to the number of centres they already possess, to be used for the purpose of raising other departments within the university to their level.

(6) Centres for advanced study should seek to bring the relevant teachers of their affiliated colleges into closer contact with their work.

8 The recurring and capital costs of the major universities should be met by the UGC. 11.17—35

9 *Improvement of Other Universities.* The major universities should be utilized to provide teachers of quality to the other universities and to the affiliated colleges. From this point of view,

- (1) every effort should be made to induce talented students from the major universities to join the teaching profession and to place a majority of them in universities and colleges, other than their own, so that they can help to raise standards;
- (2) the UGC should sponsor a scheme for instituting a number of fellowships at three levels—lecturers, readers and professors. Outstanding persons, who may otherwise be lost to the profession,

- should be granted these fellowships and seconded to work in suitable departments of universities, care being taken to see that they are appointed against permanent posts as early as possible.
- (3) the universities and affiliated colleges should be encouraged, so far as possible, to pre-select their new teachers and attach them to the major universities for a specified period;
 - (4) strong inter-university links should be formed among members of centres of advanced study, members of aspirant centres, leading university departments and outstanding affiliated colleges, in particular fields of research;
 - (5) invitations may be given to promising scholars and scientists from other universities or affiliated colleges to do research and to conduct seminars (say, for a term or a session) at one of the centres of advanced study;
 - (6) the other universities should be helped, through concentration of resources, to develop excellence in selected departments and ultimately to raise them to the level of centres of advanced studies.

11.36-39

10 *Development of Affiliated Colleges.* There are several colleges of long standing which have done and are doing as good work as any good university and it should be an objective of educational policy to encourage them. The following steps may be taken to assist in this process:

- (1) Affiliated colleges should be classified in terms of the level of their performance and assistance should be related to such classification.
- (2) Where there is an outstanding college (or a small cluster of very good colleges) within a large university which has shown the capacity to improve itself markedly, consideration should be given to granting it an 'autonomous' status. This would involve the power to frame its own rules of admissions, to prescribe its courses of study, to conduct examinations, and so on. The parent university's role will be one of general supervision and the actual conferment of the degree. The provision for the recognition of such autonomous colleges should be made in the constitution of the universities. It should be possible, by the end of the Fourth Five Year Plan, to bring at least fifty of the best colleges under this category.

11.40-41

11 *Improvement of Teaching and Evaluation.* (1) The number of formal classroom and laboratory hours should be somewhat reduced. The time thus saved should be devoted, under the guidance of instructors, to independent study, assigned reading, writing of essays, solving of

problems and small research projects in which the student seeks out and learns to use independently the books and documents he needs.

(2) Every effort should be made to build up good libraries in universities and colleges.

(3) It is most important to emphasize original thinking in the study of all subjects and to discourage memorizing.

(4) There should be a possibility of undergraduates coming into occasional contact with senior and outstanding teachers, particularly when a new subject has to be introduced for the first time.

(5) The content and quality of lectures in general needs to be considerably improved. One way of characterizing the level of class work is that every one hour of instruction should receive about 3-4 hours of study-time to digest the lectures.

(6) It may be laid down as a rule that no teacher should be away from his institution during 'term time' for more than seven days in a year.

(7) All new appointments should be made during vacation time so that teachers join their new posts at the beginning of the academic year. Further, unless there be compelling reasons, no teacher should be permitted to leave an institution to take up another appointment during term time.

(8) There is great need for experimentation, especially in two important areas. One such area concerns the manner of handling larger numbers of students without a proportionate increase in educational expenditure or the number of faculty members. Another desirable experiment would be to have a certain amount of teaching done by research students and by selected postgraduate students after their first year.

(9) The problem of teaching methods in higher education has been relatively neglected. It should be examined by the UGC through a special committee appointed for the purpose. The schools of education should make a special study of the teaching methods, not only at the school stage, but also in the universities and affiliated colleges.

(10) In all teaching universities, external examinations should be replaced by a system of internal and continuous evaluation by the teachers themselves.

(11) In universities with affiliated colleges, a system of internal assessment should supplement the external examination.

(12) The University Grants Commission should set up a Central Examination Reform Unit to work in collaboration with the universities. Special units for examination reform should also be set up in some universities who can be persuaded to organize examination reform in a big way.

(13) University teachers should be reoriented to adopt the new and

improved techniques of evaluation through a large programme of seminars, discussions or workshops.

(14) Early measures should be taken to abolish payment of remuneration to examiners. As a first step, the total number of scripts to be examined by any teacher during a year should not exceed 500. 11.42-57

12 *Medium of Education.* (1) The regional languages should be adopted as media of education at the university stage in a phased programme spread over ten years.

(2) At the earlier stage of the undergraduate course, the bulk of the instruction may be given through the regional language while at the postgraduate stage, it may be in English.

(3) In due course, all teachers in higher education should, as far as possible, be bilingual and postgraduate students should be able to follow lectures and use reading materials in the regional language as well as in English.

(4) The maintenance of colleges teaching through the medium of Hindi in the non-Hindi areas or of Urdu in any part of the country where there is a reasonable number of Urdu-speaking students, should be permitted and encouraged.

(5) Centres of advanced study should be established for the development of all modern Indian languages including Urdu.

(6) The classical and modern Indian languages should be provided as elective subjects, no language being made a compulsory subject of study at the university stage.

(7) Adequate facilities should be provided in universities and colleges for the study of English. Special units for teaching English should be established in universities to give a good working knowledge of it to new entrants by the adoption of modern teaching techniques. It would also be an advantage to teach some English as part of the elective subject course in the first year of the degree course.

(8) The teaching of important library languages other than English should be stressed, in particular the study of Russian, on a larger scale.

11.58-61

13 *Student Services.* Student services are not merely a welfare activity but constitute an integral part of education. These should include orientation for new students, health services, residential facilities, guidance and counselling including vocational placement, student activities and financial aid:

(1) All institutions of higher education should organize orientation programmes for new students in the beginning of the academic year to facilitate adjustment. Each student should be assigned

to an academic adviser who would assist him in planning and organizing his programme and studies. Every member of the teaching faculty should be expected to serve as an academic adviser to a group of students.

- (2) Steps should be taken to organize, on a high priority basis, adequate health services in universities and colleges. Adequate provision should also be made for health education of students. The UGC may explore the possibility of organizing health services for university teachers and students on the lines of the Contributory Health Services of the Government of India.
- (3) Hostel accommodation should be provided, as soon as possible, for about 25 per cent and 50 per cent of the enrolment at the undergraduate and postgraduate stages, respectively.
- (4) Day-study Centres, with subsidized or low-cost cafeterias, should be provided for about 25 per cent of the non-resident students.
- (5) There should be at least one counsellor for every one thousand students. A project for the training of counsellors should also be organized in some university. A combined information and employment centre should function directly under the supervision of the dean of students in each university.
- (6) It is necessary to develop a rich and varied programme of co-curricular activities for students not only during term-time but also during vacations.
- (7) There should be a full-time dean of student welfare for the administration of welfare services. 11.62-72

14 *Student Unions.* (1) Each university should decide how its student union will function, as experimentation in this matter is welcome.

(2) Membership of the student union should be automatic, but every student should be expected to choose at least one activity organized in the union.

(3) The office-bearers should be elected indirectly by the different student societies in the university, those who spend two or more years in the same class being disqualified for the purpose.

(4) Joint Committees of teachers and students should be established and fully utilized to ascertain and redress the genuine difficulties of students.

(5) The UGC should take initiative in convening and financially supporting an annual conference of representatives of the student unions in universities and colleges. 11.73-76

15 *Student Discipline.* (1) Education should enable young men and women to learn and practise civilized forms of behaviour and to commit themselves to special values of significance.

(2) The responsibility for indiscipline taking place is multilateral and no effective solution is possible unless each agency—students, parents, teachers, State Governments and political parties—does its own duty.

(3) Earnest efforts should be made to remove the educational deficiencies that contribute to student unrest and set up an adequate consultative and administrative machinery to prevent the occurrence of acts of indiscipline.

(4) The incentives to positive discipline have to come from opportunities that the institution presents to the intellectual and social demands it makes on the students. A better standard of student services is also necessary.

(5) The whole university life should be treated as one and polarization between teachers, students and administration should be avoided.

11.77-80

CHAPTER XII

HIGHER EDUCATION : ENROLMENT AND PROGRAMMES

12.01 In this chapter we discuss problems relating to expansion of higher education and allied questions. These will include the regulation of the expansion of the university system in terms of manpower needs for national development; the selection of students; the establishment of new universities and colleges; and the development of new courses in higher education. We also propose to discuss some problems relating to the development of educational research.

EXPANSION OF FACILITIES IN HIGHER EDUCATION

12.02 *Expansion of Higher Education in the First Three Plans.* One of the important features of educational development in the post-Independence period has been the rapid expansion of professional education in engineering, medicine and agriculture and of science courses for the first and second degrees. This was necessitated by the programmes for economic development undertaken in the first three plans. By and large, this expansion has outstripped the facilities available (in real terms) and has had an adverse effect on standards. At the same time, there has also been a rapid expansion in arts and commerce courses at the first degree level; and this has been dictated, not so much by the enrolment capacity of the institutions concerned or the employment opportunities available, but by the pressures of public demand which have increased immensely on account of the reasons which have been discussed more fully elsewhere¹³⁹. The effect of this expansion on standards has been even more adverse.

12.03 Table 12.1 gives the enrolment in higher education during the first three five year plans.

Some interesting points emerge from this table:

- (1) Enrolments at the undergraduate stage in arts, commerce and science courses have increased from 191,000 in 1950-51 to 759,000 in 1965-66 or at an average annual rate of 9.6 per cent. The enrolment of girls at this stage shows considerable improvement—the number of girls enrolled for every 100 boys increased from 13 to 24.

¹³⁹ Vol. I, Chapter V.

TABLE 12.1 ENROLMENT IN HIGHER EDUCATION (1950-51 to 1965-66)

	1950-51						1955-56						1960-61						(000's)	
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	1965-66 (Estimated)	
<i>Arts, Commerce and Science</i>																				
1. Undergraduate courses in arts and science	153	22	175	249	46	295	313	82	396	550	147	697								
2. Undergraduate courses in commerce	16	..	16	27	..	27	38	..	38	61	1	62								
TOTAL	169	22	191	276	46	322	351	83	434	611	148	759								
<i>Postgraduate</i>																				
3. M.A. & M.Sc.	14	2	17	21	4	25	38	9	47	62	16	78								
4. Research	1	..	1	2	..	3	4	1	4	6	1	8								
TOTAL	15	2	18	23	4	28	41	10	51	69	17	86								
<i>Professional</i>																				
5. Undergraduate	46	4	50	74	7	82	131	15	147	195	33	227								
6. Postgraduate and Research	4	..	4	6	1	7	12	1	13	20	2	22								
TOTAL	50	4	54	81	8	89	143	16	160	215	35	249								
GRAND TOTAL	234	28	263	380	58	439	535	109	645	895	200	1,094								
Percentage of total enrolment to population in the age-group 18-23	1.2	0.1	0.7	1.7	0.3	1.0	2.2	0.5	1.4	3.3	0.8	2.1								

Source. For sources and details of tabulation, please see Appendix I.

.. = Negligible.

Note. (1) The totals do not tally on account of rounding.

(2) For State-wise distribution of enrolment in higher education see chart on p. 553.

- (2) In postgraduate courses in arts and science and in research, the total enrolments have increased from 18,000 in 1950-51 to 86,000 in 1965-66 or at an average annual rate of 11 per cent. The enrolment of girls shows a considerable improvement at this stage also—it rose from 13 for every 100 boys in 1950-51 to 25 in 1965-66.
- (3) In professional education,¹⁴⁰ enrolments have risen from 54,000 in 1950-51 to 249,000 in 1965-66. The rate of growth is faster than that in arts and science—at 10.7 per cent per year—but a little less than that at the postgraduate stage.
- (4) The professional courses like engineering or medicine, which are generally longer and take five to six years, are really comparable to the postgraduate courses in arts and science. It will be seen from Table 12.1 that, in 1950-51, the enrolment in the postgraduate courses of arts and science was 18,000 or about one-third of the total enrolment in professional education in that year. By and large, this proportion has remained fairly constant throughout the period under review. It highlights the need to increase the postgraduate courses, particularly in the sciences.
- (5) Taking the enrolments in higher education as a whole, we find that these have increased, during this period, from 263,000 to 1.1 million or at an average annual rate of 10 per cent. The total enrolments in professional courses stood at 72,000 or 27.4 per cent of the total in 1950-51. In 1965-66, they had increased to 335,000 or 30.6 per cent of the total.

12.04 In using these statistics for internal or international comparison, some important points deserve emphasis.

(1) *Internal Comparison.* In most countries, the duration of the first degree course is about the same, irrespective of the fact whether it is a degree in arts, science, engineering or medicine. The degrees of the different faculties are, therefore, broadly comparable. In India, on the other hand, the first degree in arts, commerce and science is of a much shorter duration, just like a 'half-way degree'.¹⁴¹ It cannot, therefore, be equated with the first degree in agriculture or engineering or medicine which has a much longer duration. In fact, it is the postgraduate degrees in arts, commerce or science which are comparable with the first degrees in agriculture, engineering or medicine.

¹⁴⁰ This includes courses in agriculture, teacher training, engineering and technology, law, medicine, veterinary science, forestry and a few others. In the statistics published by the Ministry of Education, all courses in commerce have been classified as 'professional'. We have, however, followed the decision of the Planning Commission and regarded the courses in commerce for the first degree as forming part of general education and comparable with courses in arts. Courses for the second degree (M. Com.) have been classified as 'professional'.

¹⁴¹ See Vol. I, Chapter II.

(2) *International Comparison.* In international comparison it would be wrong to compare our first degrees in arts, commerce or science with the corresponding first degrees of educationally advanced countries. What is really comparable is our second degrees in arts, commerce and science and first degrees in agriculture, engineering and medicine with the first degrees given by universities in the educationally advanced countries. This has been shown in the chart on page 555. The following conclusions which can be drawn from this comparison have an important bearing on the programmes of future development:

- (a) The overall expansion of higher education in India is far too meagre in comparison with that in the more industrialized countries.
- (b) What is even more important, enrolments in the professional courses, particularly in science and agriculture, are extremely inadequate for the needs of our economic development.
- (c) Our system of higher education is more wasteful (lower ratio of output to input) than in countries like the UK or the USSR.
- (d) The provision for part-time education or correspondence courses which is made on a very largescale even in affluent countries like the UK, the USA and the USSR, is conspicuous by its absence in our system of higher education.

12.05 *Future Enrolment Policy.* What should be the enrolment policy in higher education during the next twenty years? Our recommendation is that the expansion of facilities in higher education should be planned broadly on the basis of general trends regarding manpower needs and employment opportunities. At present, there is an overproduction of graduates in arts and commerce because of the adoption of this open-door policy; and consequently, there is a growing incidence of unemployment amongst them. On the other hand, there is a shortage of professional specialists and there is a consequent need to increase the facilities in professional courses such as agriculture, engineering, medicine, etc., and especially at the postgraduate stage in science and arts.

12.06 The ISI/LSE Paper¹⁴² has made the following forecasts of trained manpower at this stage for 1985-86:

- (1) *Undergraduate Stage (Arts, Commerce and Science).* These enrolments are expected to increase from 759,000 in 1965-66 to 2.2 million in 1985-86 or at an average rate of 5.3 per cent.
- (2) *Professional Education (Excluding Law).* The enrolments at the undergraduate stage in professional education, excluding law but including teaching, are expected to rise from 195,000 in 1965-66 to 972,000 by 1985-86 or at an average annual rate of 8.4 per cent as shown in Table 12.2.

¹⁴² See Vol. I, Chapter V, for details.

Number of University Students per Million of Population 1964-65

STATE-WISE ANALYSIS

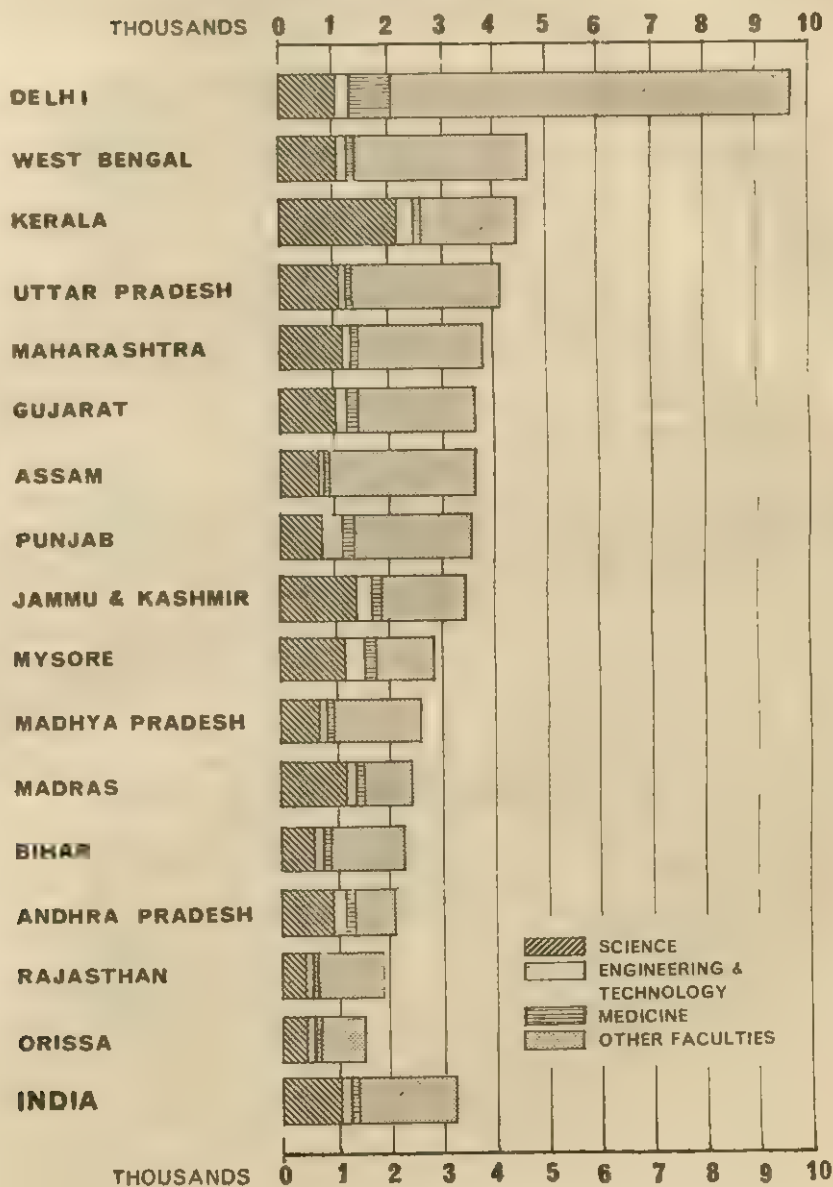


Fig. 24

TABLE 12.2. OUT-TURN, INTAKE AND ENROLMENT OF SPECIALISTS

	Out-turn			Intake			Enrolment		
	1960-61	1975-76	1985-86	1960-61	1975-76	1985-86	1960-61	1975-76	1985-86
<i>Engineering</i>									
First Degree .	7	43	92	14	65	129	40	229	473
<i>Agriculture</i>									
First Degree .	3	13	42	5	23	64	12	39	115
<i>Medicine</i>									
First Degree .	5	16	34	6	23	43	35	125	245
<i>Teacher Training</i>									
Graduates .	18	73	115	20	81	128	22	88	139
TOTAL	33	145	283	45	192	364	109	481	972

(3) *Postgraduate and Research.* The ISI/LSE paper gives no projections for this stage. In 1965-66, the enrolments at this stage were 108,000 as against a total enrolment of 986,000 at the undergraduate stage (or about 11 per cent). We recommend that this proportion should be raised, by 1986, to about 30 per cent. This will imply that these enrolments will rise from 108,000 in 1965-66 to about 960,000 in 1986 or an average annual increase of 11.5 per cent.

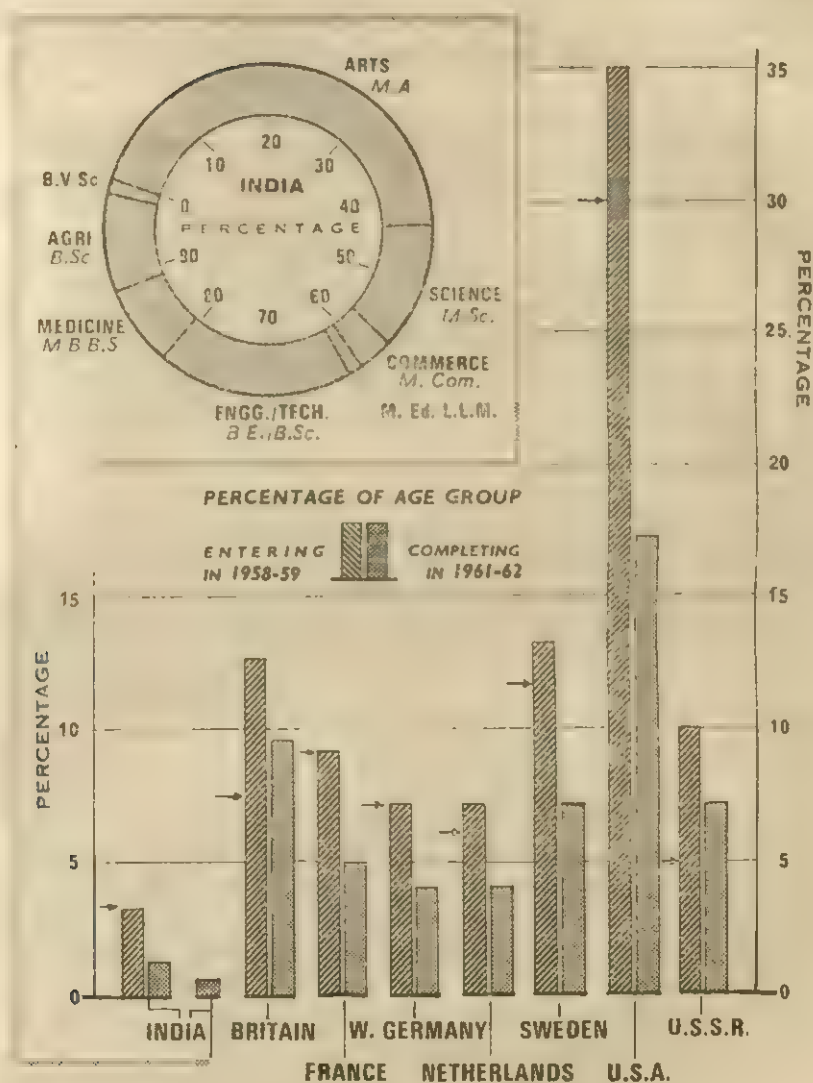
(4) *Law.* The ISI/LSE paper gives also no projections for legal education. We have assumed that the enrolments at the undergraduate stage in legal education would increase from 32,000 in 1965-66 to 76,000 by 1985-86.

12.07 On the basis of these assumptions, the total enrolments in higher education in 1975-76 and 1985-86 will be as shown in Table 12.3.

TABLE 12.3. PROJECTED ENROLMENT IN HIGHER EDUCATION IN 1975-76 and 1985-86

Type of education	Projected enrolment (in 000's)	
	1975-76	1985-86
1. Undergraduate (General)	1,350	2,152
2. Undergraduate (Professional) as estimated by ISI/LSE Paper	481	972
3. Undergraduate enrolment in legal education	50	76
TOTAL (Undergraduate)	1,881	3,200
4. Postgraduate	321	960
TOTAL (Higher education)	2,202	4,160

Input — Output in Higher Education



1. Portions below the arrow (→) indicate percentage taking full-time courses
2. Input & output figures for India relate to years 1959-60 & 1962-63 respectively
3. Figures except for India are from the Robbins Report on Higher Education in U.K. (1963).

Fig. 25

It may be pointed out that

- in the first three plans, the enrolments in arts, commerce and science at the undergraduate stage increased by 568,000. During the next twenty years, they are expected to rise by about 1.4 million. The average annual rate of expansion will, however, be reduced from 9.0 per cent to 5.3 per cent;
- in professional education at the undergraduate stage (including teaching and law) the enrolments increased, during the first three plans, by 177,000; in the next twenty years they will increase by 821,000, although the average annual rate of growth would be reduced from 10.6 per cent to 7.9 per cent; at the postgraduate stage, enrolments increased in the first three plans by 86,000; in the next twenty years these will increase by 852,000 and the average annual rate of growth will also have to be slightly accelerated from 11 to 11.5 per cent.

12.08 As pointed out earlier,¹⁴³ these estimates of manpower needs enrolments are tentative and will have to be continually revised in the light of experience gained. Moreover, these are estimates for the country as a whole. For practical implementation, they will have to be broken down according to the States; and finally an attempt will have to be made to correlate broadly the enrolment and output of the universities with these estimates, as revised from time to time. This is a difficult task. But we expect that the UGC under the general guidance of the Planning Commission will be able to cope with it.

12.09 The need for reducing the rate of expansion at the undergraduate stage in courses of arts and commerce has been discussed elsewhere.¹⁴⁴ Similarly, we have highlighted the need for expanding science education of quality and for increasing professional education at the undergraduate stage especially in agriculture, engineering and teaching.¹⁴⁵ It is, however, necessary to explain why a large expansion is also needed at the postgraduate stage and in research. An analysis of our proposals will show that this is fully justified because

- we expect a proportion of teachers even in lower secondary schools to hold the master's degree;
- we have recommended that a master's degree should be the minimum qualification for all teacher-educators both at the primary and at the secondary level;
- the lengthening of the duration of the higher secondary stage uniformly to two years and the expansion visualized at this stage will

¹⁴³ Vol. I, Chapter V.

¹⁴⁴ Vol. I, Chapter V.

¹⁴⁵ Chapters IV (Vol. I), XIV, XV and XVI

- need a very large number of teachers with postgraduate qualifications;
- the large expansion visualized at the undergraduate and the postgraduate stages itself will need several times more teachers with postgraduate and research qualifications than at present; and
 - the number of professional persons needed in research, agriculture, industry and the services has to be increased very substantially.

SELECTIVE ADMISSIONS

12.10 *The Need.* In the first three five year plans a policy of open-door access has been in operation in courses in arts and commerce in most of the affiliated colleges. A stage has, however, now been reached in the process of expansion when the policy of selective admissions will have to be extended to all sectors and institutions of higher education. If the present rate of expansion (at 10 per cent per year) is assumed to continue for the next 20 years, the total enrolments in higher education would be between seven and eight million by 1985-86 or more than twice the estimated requirements of manpower for national development. An economy like ours can neither have the funds to expand higher education on this scale nor the capacity to find suitable employment for the millions of graduates who would come annually out of the educational system at this level of enrolment. There is no escape but to link broadly the total enrolments in higher education to manpower needs, and to bridge the gap between these enrolments and the demand for higher education by adopting a system of selective admissions.

12.11 This conclusion, which is based mainly on two considerations—paucity of resources and relating the output of the educational system to manpower needs—can also be supported on academic grounds. Standards in higher education will tend to rise if there is competition for admission and the best students are selected on the basis of merit. We are happy to note that the earlier opposition to this principle is gradually lessening and our discussions with officials and non-officials whom we met has led us to conclude that public opinion is now largely in favour of making admissions to higher education selective. The reform should, therefore, be introduced as early as possible.

12.12 *The Main Elements.* Three main elements are needed for operating a programme of selective admissions in higher education:

- the determination of the number of places available in an institution in relation to teachers and facilities available to ensure that standards are maintained at an adequate level;

- prescription of eligibility by the universities; and
- selection by the institution concerned of the best students from amongst those who are eligible and seek admission.

12.13 *Determination of Places Available.* We suggest that each university decide in advance the number of students to be admitted in each course in its teaching departments and separately in each of its affiliated colleges on the basis of the facilities available. This is already being done for professional and science courses. But even here, it is necessary to make the conditions more stringent. It is even more important to take similar steps in the courses in arts and commerce as well. The main difficulty is that no objective and specific criteria have been evolved for the purpose and the determination of the number of seats available with reference to the facilities provided is very elastic. We, therefore, recommend that the universities should evolve specific norms and criteria for determining the number of seats to be permitted in courses in arts and commerce. These should take into account, among other things, the student-teacher ratio, the facilities available for self-study, the library books, the journals subscribed, the number of library seats, the provision for tutorials, etc. The problem is so important that the UGC may consider the appointment of a committee to examine it in detail and make its findings available to the universities. It would then be possible to determine, with greater accuracy than at present, the number of students who can be admitted in arts and commerce courses with a reasonable hope of receiving a good education.

12.14 We would like to lay special emphasis on the determination of places in all affiliated colleges and in courses in arts and commerce because it is in these courses and in these institutions that most of the uncontrolled expansion takes place. It is imperative that the intake of students be fixed separately for each such institution and that this sanctioned strength should form an integral part of the conditions of affiliation. We have found many instances where the universities have not scrupulously discharged this responsibility and this has been one of the principal reasons for the deterioration of standards.

12.15 *Eligibility.* We have recommended elsewhere¹⁴⁶ that the present examination system should be reformed, that no one should be declared to have passed or failed in the higher secondary examination and that every student appearing should be given a certificate showing his performance. The universities, therefore, will have to prescribe, from time to time, conditions for 'eligibility', e.g., conditions for entitling a student to seek admission to their courses. These would naturally vary

¹⁴⁶ Vol. II, Chapter IX.

from university to university and from course to course. Care should, however, be taken to ensure that they are defined with some measure of elasticity so as to permit the admission of all really promising students.

12.16 *Methods of Selection.* Once the number of places available is determined and the conditions of eligibility are prescribed, the stage is set for making selection for admissions. We visualize that, as secondary education expands and its quality improves, more and more students would become eligible and seek admission and that, in most institutions, the number of applicants for admission would exceed the places available. The position, however, would vary considerably from institution to institution. In good and well-established institutions, the number of applicants would be several times the places available while in some others, it may be just equal to or a little more than the number of seats. The selection of students for admissions would, therefore, pose a problem of varying magnitude and complexity from institution to institution. We recommend that each institution should decide its own procedure for selecting the best students from among the eligible applicants on the basis of its traditions and local conditions.

12.17 The search for good and reliable methods of selection is one of the important problems in higher education and vigorous research is needed to evolve them. Even in advanced countries, satisfactory techniques of selection have not been developed as yet. While the search for good methods goes on, we have to begin the programme with such *ad hoc* methods as are available. We make the following general suggestions which, we hope, would be of use to institutions in devising their methods of selection.

(1) The common practice at present is to use examination marks rigidly as the sole criterion of merit and as the basis for selection. There is, however, little academic justification for it. Examination marks are notoriously unreliable for measuring attainment. Their prognostic value for determining the ability to profit from higher education is even more limited and several studies have shown that the correlation between school leaving examination marks and success in a college is not significant. Not many problems arise, however, at the extreme ends of the scale and it is easy to select a first or high second class student for admission or to reject one who has just scraped through the examination. But as one approaches the border-line of eligibility, the examination marks cease to serve as a reliable guide. For instance, the present situation where a debate often takes place whether a student with 39.6 per cent marks should or should not be admitted (the prescribed marks for admission being 40 per cent), and where such a student may be

admitted in one college or faculty but not in another, is Pickwickian, if not absurd. We recommend that while the use of examination marks as a major basis for admissions may continue as an interim measure until better selection methods are devised, their arbitrariness or lack of reliability should be compensated, to the extent possible, by taking other relevant considerations into account and by making due allowance for the socio-economic handicaps of students so as to relate selection more directly to innate talent. As was stated above, this is specially important in borderline cases.

(2) It would be desirable that, in selecting students for admission, the institution should take into consideration the examination marks, the school record, the proficiency of the student in fields not tested in the examination, and such other relevant factors. If necessary, there should be an interview and a written examination, specially designed for testing aptitudes in relation to the fields of study which the student desires to take up. The final selection should be made on the basis of all this evidence and not on examination marks alone.

(3) In very exceptional cases of students with unusual gifts in some limited field (e.g., mathematics) it should be possible to relax even the minimum requirements prescribed for admission. It is by no means rare that a gifted student is unable to fulfil the minimum requirements for university entrance. If the rules on this score are rigidly and mechanically enforced, many a gifted student would never enter a university and this could be a serious national loss. In exceptional cases, therefore, the universities should have the right and the courage to suspend the rules and give admissions to students whose talent has been identified but who may not have been able to fulfil the entrance requirement for some reason. This authority may also be delegated to a few select affiliated colleges which can be trusted to maintain standards and exercise this right with care and discretion.

(4) A major objective of policy in selecting students for admission should be to secure social justice and to spread the net wide enough to catch all available talent. It will be necessary, therefore, to make some allowance for the handicaps created by the adverse conditions in which many students from rural areas, from urban slums and from the unprivileged classes have to study. From this point of view, the procedure for selecting students on the basis of 'school clusters' which we have already recommended for the award of scholarships¹⁴⁷ may be adopted for making admissions, especially to much-sought-after quality institutions.

12.18 *University Boards of Admissions.* For the successful implementation of this scheme, it will be necessary to set up a suitable machinery

¹⁴⁷ Vol. I, Chapter VI.

responsible for the selection and placement of students, for giving them special tuition, where necessary, and for providing the necessary financial support. At present, selection is usually not dealt with as a serious problem either at the university or in the colleges. At the commencement of each academic year, it becomes a hectic activity and is then forgotten. It is obviously not possible to build up a good admission policy on the basis of such intermittent experience. We recommend that each university should constitute (if it does not already have one) a Board of University Admissions, which should include representatives of the teaching departments of the university, affiliated colleges and the university administration. Its function should be to advise the university about all matters relating to admissions to teaching departments and the affiliated colleges, to review the implementation of admission policies from year to year, and to recommend any necessary changes. It should also be a responsibility of this Board to collect data relating to annual admissions and to analyse them so as to find out to what extent the objectives of the admission policies have been actually realized. The results should be published for general information. The UGC as a central clearing-house, should also undertake studies and coordination of developments in this field.

12.19 *Central Testing Organization.* The development of appropriate selection procedures for different courses of higher education is a technical process and it is necessary to create a suitable agency which will be able to deal with it effectively in due course. We recommend that the University Grants Commission may take the initiative in setting up a Central Testing Organization with the following objectives:

- to develop improved procedures for selection of students at various levels of university education and for various courses or branches of learning offered by the colleges and universities;
- to provide the necessary services to colleges and universities such as administering selection tests, supplying the test results and suggesting ways and means of utilizing the results for selection;
- to promote research within the universities into testing and related areas, with special reference to improvement of selection procedures at the university level;
- to advise colleges, universities and other similar organizations with regard to the selection of students;
- to establish field contacts so as to determine the requirements of different universities and colleges for the selection of students and to coordinate these activities at the national level;
- to establish contacts with similar agencies in other countries; and

— to make a continuing study of new developments in the field, in order to refine and improve selection procedures further.

12.20 The work to be done by such an organization will be extremely difficult and cover a very wide field. It would, therefore, be unrealistic to expect that it would be able to make a definite impact on admission practices and procedures in the immediate future. It is all the more important, therefore, that a programme for its development be prepared in the current plan. This should be divided into two phases. The first phase, which may take about three years, should be devoted to the preliminary work needed to set up the organization and develop a few pilot studies and experimental programmes. In the second phase, to cover the next three years, we may expect the organization to be fully operative with the necessary staff, accommodation and equipment which would include a security printing press.

PART-TIME AND OWN-TIME EDUCATION

12.21 At present, a student at the undergraduate stage must either be admitted on a full-time basis or go without education altogether. This creates a great demand for full-time seats in colleges and leads to a deterioration of standards as the resources to provide all the seats needed are not available. One solution to this is to keep full-time seats strictly limited on the basis of resources available and to institute correspondence courses, part-time courses, evening courses, etc., for those who aspire to a university degree but are not able to get admission to the regular courses. This device is being increasingly used in many countries such as the USA, the UK, the USSR, and Japan. The correspondence courses recently started by the Delhi University as a 'pilot project' have proved to be a promising experiment and are producing satisfactory examination results.

12.22 We recommend that the opportunities for part-time education through programmes like evening colleges, and for own-time education through programmes like correspondence courses, should be extended as widely as possible and should also include courses in science and technology (either at the degree or diploma level). They will help to reduce the capital costs of expanding higher education and cut down even the recurring costs to a substantial extent, especially as enrolments grow. They are the only means to provide higher education to those who desire to study further but are compelled, on economic grounds, to take up employment at the end of the school stage. There need be no fear that they will lead to a deterioration of standards, especially if due care is taken to maintain personal contacts with the students receiv-

ing correspondence education by organizing academic programmes during vacations and holidays. In fact, it would be correct to say that, by and large, the standards in such courses tend to be better because of the more intensive motivation of the students. We suggest that by 1986 at least a third of the total enrolment in higher education could with advantage be provided through a system of correspondence courses and evening colleges. We also suggest that the UGC should establish a standing committee on part-time education.

LOCATION OF AFFILIATED COLLEGES

12.23 Most of the expansion of undergraduate education we have visualized above will have to be met in two ways—the expansion of the existing colleges and the establishment of new ones. The size of the colleges has an important effect on their costs and efficiency and it is, therefore, important to evolve a suitable policy in this matter.

12.24 We recommend that, in granting affiliation to colleges, the universities should emphasize the expansion of existing colleges, rather than the establishment of new ones. Unless there are strong reasons to the contrary, a college should have a minimum enrolment of 500 and and it would be preferable to raise the enrolment in as many colleges as possible to 1,000 or more. In granting affiliation to a new college, care should be taken to see that its location is properly planned so as not to interfere with the proper growth of an existing institution and there should be a reasonable chance that it would grow into an institution of an adequate size within a period of about five years.

12.25 *Small Colleges.* One unsatisfactory aspect of the present situation is the existence of a very large number of colleges with a very small enrolment. The latest data available on the subject is given in Table 12.4.

It will be seen that about 15.6 per cent of the colleges are in the unenviable position of having less than 100 students. If an enrolment of 500 students is regarded as the very minimum below which a college may tend to be uneconomic and inefficient, about 60 per cent of the affiliated colleges are below this level.

12.26 We carried out an examination of the small colleges with an enrolment of less than 100. Data was available for 168 institutions only, but even from this some interesting facts emerged.

(1) *Age.* The classification of the colleges according to the year of establishment is given in Table 12.5.

It will be seen that 72 per cent of these small colleges were established during the four-year period—1961-64. Whether these colleges can

TABLE 12.4. SIZE OF AFFILIATED COLLEGES (1964-65)

Enrolment	No. of colleges within the range	% of the total	No. of arts, science, commerce colleges in the range	Percentage	No. of professional colleges in the range	Percentage
Less than 100 . . .	320	15.6	168	11.0	152	28.6
Between 100—299 . . .	602	29.2	391	25.6	211	39.5
Between 300—499 . . .	296	14.4	243	16.0	53	9.9
Between 500—999 . . .	457	22.2	373	24.5	84	15.8
Between 1000—1999 . . .	328	16.0	297	19.5	31	5.8
2000 and above . . .	53	2.6	51	3.4	2	0.4
TOTAL	2,056	100.0	1,523	100.0	533	100.0

Source : Report of the University Grants Commission, 1964-65, p.1.
 N.B. See also chart on p. 567.

TABLE 12.5. CLASSIFICATION OF COLLEGES ACCORDING TO YEAR OF ESTABLISHMENT

Year of foundation	Percentage of colleges founded in the period
Before 1947	5.4
1948—57	6.5
1958	2.4
1959	7.7
1960	6.0
1961	12.5
1962	7.1
1963	16.7
1964	35.7

increase their strength with age cannot be predicted, especially in view of the fact that 28 per cent of the colleges which were established before 1960 (and some of them even as far back as 1947) have continued to have a strength of less than 100.

(2) *Population of the Locality.* Population figures of the locality in which the colleges are situated were available in respect of 114 colleges. The position is as under:

TABLE 12.6. POPULATION FIGURES OF
LOCALITY FOR 114 COLLEGES

Population of the locality (in 000's)	No. of colleges
5 and below . . .	6
5—10 . . .	14
10—20 . . .	21
20—40 . . .	22
40—75 . . .	20
75—100 . . .	3
100—150 . . .	4
150—200 . . .	3
200—400 . . .	10
400—800 . . .	4
800 and above . . .	7
TOTAL . . .	114

It will be seen that 63, or more than 50 per cent of the colleges, are situated in towns whose population ranges from 10,000 to 75,000 and there are 31 such colleges in areas whose population exceeds 75,000. It is also significant that there are 11 small colleges with enrolment of less than 100 in big cities whose population exceeds 400,000. Only 20 colleges can be said to be situated in sparsely populated areas (10,000 and below).

(3) *Enrolment of Men and Women Students.* Of these colleges, 36 enrolled only men students, 32 only women students; in 97, admission was open to both men and women students.

(4) *Backward Areas.* Some of these colleges are in backward areas with large tribal population and it is understandable that they may take some years to grow.

Planning the location of colleges is a problem of great importance. We recommend that the UGC should undertake a study of the problem

with special reference to the small colleges and advise the universities regarding the manner in which this handicap may be reduced as much as possible.

EXPANSION OF POSTGRADUATE EDUCATION AND RESEARCH II

12.27 The bulk of postgraduate and research work has to be concentrated in the universities and their constituent colleges rather than in the affiliated colleges. Indian universities have, in the past, been mainly concerned with undergraduate education and, to a limited extent, with postgraduate work and research. As a result of the lead given by the UGC in the Second and the Third Plans, however, the number and enrolments in the postgraduate departments in the universities have increased considerably. But even now, the share of the colleges in the enrolments is disproportionately large: the distribution of M.A. and M.Sc. students between the teaching departments of the universities and the affiliated colleges is roughly in the proportion of 4:3. This is an unsatisfactory state of affairs because, barring a few outstanding colleges, real research facilities in affiliated colleges are very limited or non-existent. Moreover, the facilities in terms of competent teachers, libraries, laboratories, etc., in a large majority of colleges are weak and the standard achieved by students admitted is low. We recommend that the bulk of postgraduate and research work should be organized in the universities or in university 'centres' where good programmes can be developed cooperatively by 3 or 4 local colleges under the guidance of the university. Only very good affiliated colleges of long standing which have done creditable work at the undergraduate (or postgraduate) stage may be allowed to carry on postgraduate and research work, if the needed facilities are provided. In our opinion, the universities and the university centres will have to shoulder the responsibility for about 80 per cent of the postgraduate and research work. To support it properly, they will also have to undertake undergraduate work meant primarily for gifted students. This should cover about 10 per cent of the enrolment. The universities thus have a tremendous additional responsibility to undertake; the enrolments in their departments, and constituent colleges would have to be increased from 200,000 in 1965-66 (undergraduate 155,000 and postgraduate and research 45,000) to about 1.1 million in 1985-86 (undergraduate 320,000 and postgraduate 750,000).

12.28 It need hardly be stressed that though it is necessary to increase the enrolments at the postgraduate stage in response to developmental needs, this should always be contingent on adequate increase in material and staff resources. One has to resist the temptation to open or to

Affiliated Colleges, by Size, 1964-65

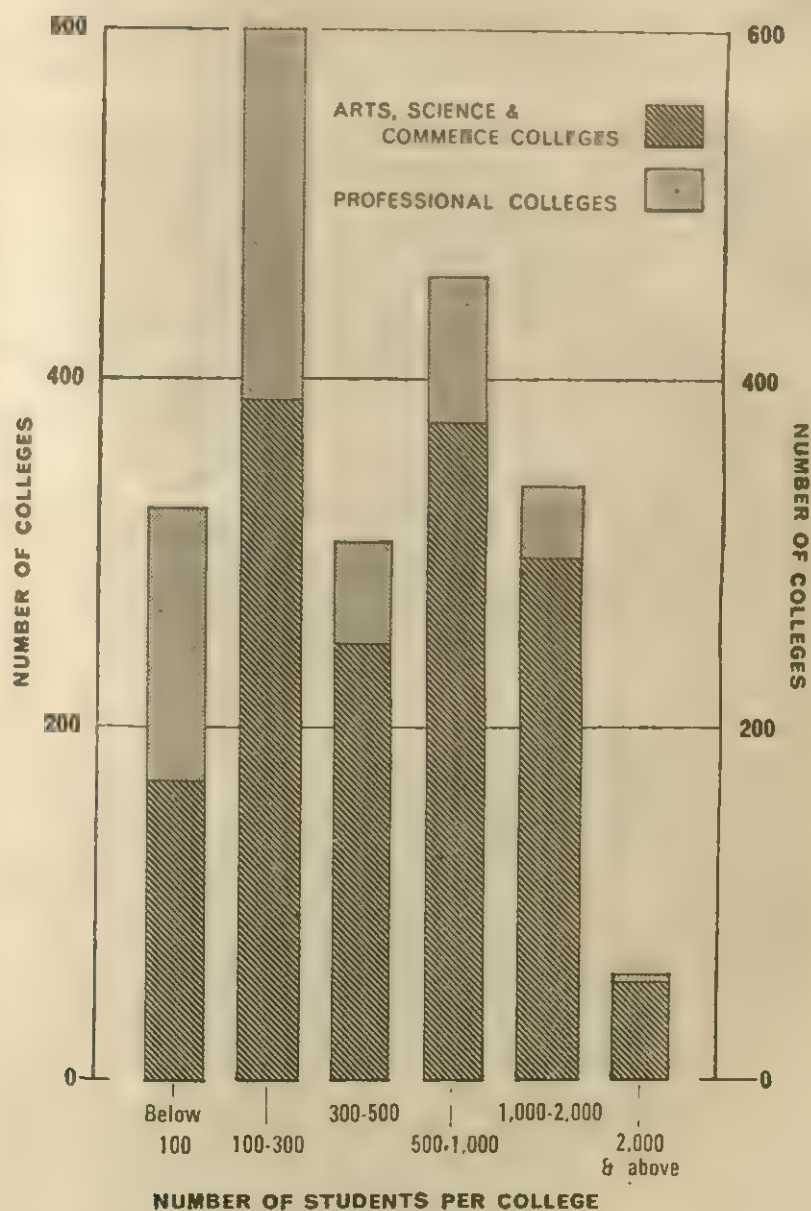


Fig. 26

tolerate departments of universities or colleges doing inferior post-graduate work without the essential facilities.

12.29 It is also necessary to have a strict policy for admission of students to postgraduate and research courses. We should not encourage students who go on to M.A. or M.Sc. merely to while time away or on the off-chance of being able to find some employment later. This is often permitted in many institutions at present, either due to misplaced charity or to inflate numbers, not realizing that such measures constitute a grave injury to the interests of higher education in the first instance and to the community itself in the long run. We suggest that a rigorous test of admission should be introduced for all post-graduate courses. A mechanical dependence on marks in the first degree examination will not serve the purpose. In a pilot project undertaken by the Delhi University to analyse its examination results over the last 4 or 5 years, it was found that the chances of a third division student in B.A./B.Sc. securing first, second or third division in the M.A./M.Sc. examination are 0.29, 0.29 and 0.47, respectively. This is undoubtedly a limited study but it is certainly an important pointer. It is, therefore, necessary to take into account, in addition to the marks obtained at the qualifying examination, the students' cumulative record of performance, his interest in extracurricular and co-curricular activities, and his aptitude, motivation and general suitability for higher education.

12.30 In view of the centralization of postgraduate and research work indicated above, it will be necessary to provide an adequate number of scholarships and hostel facilities at this stage. As suggested earlier,¹⁴⁸ scholarships should be available to about 50 per cent of the students at this stage and these should be supplemented by loan scholarships. Once a student has been selected for admission to a postgraduate course on merit, we should strive to ensure that no financial difficulty comes in the way of his completing his studies: either a scholarship or a loan scholarship should be available to him so that he can devote himself to his project without anxiety and uncertainty.

12.31 We would like to emphasize one point. The Centre will have to assume far greater responsibility than in the past for the development of postgraduate education and research and for the development of universities. This is a sector of very high priority and it has a seed value and can improve the whole field of education. At present, this is not the case. The extent of facilities provided at this stage are inadequate and its quality leaves much to be desired. Consequently, we do not get enough good teachers for colleges. This dilutes undergraduate education and makes it difficult to get good teachers for secondary schools. In its turn, secondary education is thus diluted and it becomes

¹⁴⁸ Vol. I, Chapter VI.

difficult to get good teachers for elementary schools. The only way to break this vicious circle is to expand the facilities in postgraduate education and research and what is even more important, to improve their quality. For this purpose, we would move in the direction of making the Government of India almost exclusively responsible for postgraduate education and research. In this connection we would like to quote the US President's Science Advisory Committee which in its recent report on *Scientific Progress, the Universities and the Federal Government* (1960), prepared under the chairmanship of Professor G. T. Seaborg, now Chairman of the Atomic Energy Commission, states as follows:

Both basic research and graduate education must be supported in terms of the welfare of society as a whole. It is in this large sense that the role of the Federal Government is inevitably central. The truth is as simple as it is important: whether the quantity and quality of basic research and graduate education in the United States will be adequate or inadequate depends primarily upon the government of the United States. From this responsibility the Federal Government has no escape. Either it will find the policies—and the resources—which permit our universities to flourish and their duties to be adequately discharged—or no one will.

These are wise and powerful words, and they apply to us no less.

HIGHER EDUCATION FOR WOMEN

12.32 *Need for Expansion.* There is a prevailing view that it is no longer necessary to give special attention to women's education at the level of higher education since women are taking advantage of it in increasing numbers adequate to the needs of society. Shortages of educated women available for taking up positions of directional and organizational responsibilities in various professions and occupations, however, point to the need for special efforts to expand women's education at the college and university stage. The figures of comparative enrolment of men and women students at the higher education stage reveal that the proportion of women students to the total enrolment in Indian universities was about 13 per cent in 1955-56, about 17 per cent in 1960-61 and about 21 per cent in 1965-66. Thus, in one decade the proportion has increased from 13 per cent to 21 per cent and at present the proportion of women students to men students is 1:4. This proportion is not in keeping with the changing needs of Indian society nor with the needs of economic and social development. We feel that in view of these needs the proportion of women students to the total enrolment at this stage should be increased to 33 per cent during the

next ten years to meet the requirements for educated women in different fields. To achieve this target we have recommended two programmes elsewhere, viz.,

(1) a programme of scholarships and financial assistance to women students in colleges and universities on a liberal scale; and

(2) a programme of the provision of suitable but economical hostel accommodation for women students with all the necessary amenities on a large scale. Liberal grants should be provided by the Government of India for this purpose as also by the State Governments. Both these programmes are particularly necessary to encourage girls from rural areas to take advantage of higher education. At present their numbers are very small in colleges and universities as compared to those of girls from urban areas.

12.33 Mixed or Separate Colleges. At the college level, the local historical tradition and the general social background determine whether there should be mixed colleges or separate colleges for women. A uniform policy of co-education is not necessary for this level of education. Conditions vary from State to State. In a State like Maharashtra, mixed colleges are preferred by women students and their parents, and the number of mixed colleges is much larger than that of separate colleges for women. In the State of Madras, however, which is equally advanced in the matter of women's education, separate colleges for women are preferred and their number is much larger. It would, therefore, be for each State Government to decide its policy regarding co-education at this stage. The existing practice can be allowed to continue in each area, except where a separate college for women is so small that it is not economically viable. Care should be taken by the college authorities and the staff in mixed colleges to ensure that women students receive necessary incentives and encouragement for active participation in co-curricular and extra-curricular activities. The authorities and the staff of women's colleges should ensure that they and their students do not become isolated from the general stream of university life.

At the postgraduate level there is no justification for separate institutions for women. Here men and women students should work together under the best guidance that is available.

12.34 Courses in Higher Education Specially Meant to Serve the Needs of Women. As at present, women students should have free access to courses in arts, humanities, sciences and technology. It would be wrong to restrict their choice or to compel them to take particular courses. The more academic type of girls with ambitions of pursuing careers

of research or teaching at the college or university level, or in professions such as medicine or technology should have all the opportunities and incentives for doing so.

For a large number of women students, there is need for linking up higher education with specific avenues of employment where the services of trained and educated women are urgently required. There needs to be an emphasis on technical and vocational element in such courses. Some of the professional fields where women's services are required and where there are shortages at present, are those of education (teaching), social work, nursing and a series of occupational fields such as nutrition, dietetics, institutional management, etc. All such courses have been stressed during the Second and the Third Five Year Plans and facilities for them have been expanded. We must make every effort to expand these courses according to developmental needs and to improve them in the light of their objectives.

Home science has been introduced in 33 universities and is gradually receiving recognition as an academic discipline. Home science, in addition to giving good general education, should equip students on a scientific basis to work in the professional fields of dietetics, food technology, family welfare work, extension work in community development and Welfare Extension Project, research work in projects and schemes of ICMR, ICAR and Council of Child Welfare.

Nursing has been introduced as a course at the B.Sc. level in universities with the purpose of preparing nursing staff at higher levels. It is introduced in separate colleges for women and every attempt is made to plan a scientific and professional course which would have an academic value as well as the necessary professional training of a higher level. The expansion of this course should be according to the requirements of the profession.

Education as an elective at the B.A. or B.Sc. level has been introduced in 11 universities. In each of these universities, there are more women than men who offer this course. The course has at present only a general education value and does not serve the purpose of professional preparation even partially. Elsewhere we have suggested the value of concurrent and integrated courses in general and professional teacher education. We feel that such courses will prove to be popular with women students. With the fewer employment avenues open to women, they make up their mind about joining the teaching profession at an early stage. They would welcome such concurrent courses if the first year of the three-year degree course offers a basic general course which would lead to pedagogy as well as to some other field. We suggest that besides these institutions we have already proposed for this purpose, a few women's arts and science colleges should be selected for the introduction

of the concurrent course and given additional special grants for the purpose.

Courses in social work are offered in several universities. This is a field where there appears to be a need for designing special courses to meet the requirements of those fields of social work where women's services are required. As other avenues open up to women, courses in these fields will have to be designed.

In the Third Five Year Plan, there was a scheme to set up a National Institute for Women for giving high-level training to women candidates in organization, administration and management to enable them to take up responsible positions. Women trained on these lines would be needed for implementing many national plans and projects, particularly in social services to meet the requirements of voluntary organizations and to provide competent personnel to take up positions that are becoming increasingly available to them in the industrial sectors. For want of funds it has not yet been possible to set up such an institution at the national level. We are of the opinion that three or four universities with good business administration and management departments should set up wings for giving such high-level training as is needed by women for the above purpose. This will reduce the cost of training and will also make the training more effective and efficient.

We would like to suggest that one or two universities should set up research units to deal specifically with women's education. These should take up follow-up studies of educated women, consider women's education from the point of view of employment opportunities available to women, and ensure proper planning of women's education particularly at the stage of higher education.

NEW UNIVERSITIES

12.35 In view of the expansion visualized for the undergraduate and postgraduate stages, the establishment of some new universities is inevitable. It is even desirable to reduce the size of some existing universities. This problem has already become acute in big metropolitan cities and is likely to become so in several other universities within a few years. Moreover, we feel that administrative regroupings of existing colleges through the establishment of new universities would be necessary in certain cases.

12.36 *The Calcutta University.* We may illustrate the point by referring to one of the oldest universities in India, the University of Calcutta, which has rendered pioneering and valuable services in the past to the

development of higher education in the country, specially in the field of postgraduate studies and research. At the present time, however, one witnesses in the university a rapidly increasing and almost unmanageable undergraduate population. Half a dozen colleges in the city of Calcutta account for about 50,000 undergraduate students. Many of these do not have even a modicum of essential facilities—adequate teaching staff, accommodation, libraries, laboratories. Sometimes more than one college functions in the same building and with the same equipment, but in different shifts, and practically under one management though with separate governing bodies. Teaching and learning are often carried on in a factory-like environment where teachers and students have hardly any personal contacts whatsoever. On the academic bodies of the universities are some persons who are not competent by their academic attainments or administrative experience to play a constructive role in the working of the university. There is a considerable time lag between the conduct of examinations and the declaration of results. The University needs a major reorganization. Some of the leading colleges could be granted an amount of autonomy in the organization of their courses of studies and conduct of examinations. It would be an advantage to set up a Council of Affiliated Colleges to deal specifically with the problems of colleges. Given the seriousness of the situation, it may be advisable for the State Government in consultation with the UGC and the Government of India to have the affairs of the University closely examined by a small competent body with a view to finding a way out of the present impasse.

12.37 *Metropolitan Universities.* There is also a concentration of large student population in the cities of Bombay, Delhi and Madras, though their problems have to be seen in a somewhat different setting. We welcome the proposal to set up a second university in the city of Delhi and recommend that the other metropolitan cities of Bombay, Calcutta, and Madras should have, by the end of the Fourth Plan, two universities each which would supplement to some extent the work of each other. Moreover, some of the well-established colleges may be raised to autonomous status with power to grant degrees, to begin with, at the undergraduate stage. The relevant details and pattern of the new universities should take into account local conditions and circumstances and ensure that they are able to play a vital and constructive role in the civic life of the metropolis. We suggest that the problems be examined by the UGC in consultation with the State Governments concerned.

12.38 *Additional Universities.* Additional universities would also be needed in other States. For instance, there has been a strong and justifi-

able demand from the State of Kerala for an additional university. The State of Orissa has also a good case. There has also been a demand for the establishment of a university for the hill areas of the North Eastern Region. This proposal has been supported by a Committee appointed by the UGC, and by the Working Group on Educational Development of Hill Areas set up by the Ministry of Education in April 1965. We agree with this recommendation. The people in these hill areas share common economic disabilities and their remoteness and comparative inaccessibility render their problems peculiarly difficult. A great deal needs to be done to explore the economic potentialities of the area. Moreover, the people rightly feel that unless the promising local youth are trained for providing leadership in the various fields of economic and social development, their progress will remain arrested. They are anxious to be more fully integrated with the life of India as a whole and with the larger world of scholarship and learning. To this end, they have realized that the establishment of a university is one of the major measures which will spearhead economic and social development in the area. The hill areas of Uttar Pradesh and the tribal tracts in Orissa have also demanded the establishment of universities.

12.39 *Precautions to be Taken.* We wish to emphasize that the ban on the establishment of new universities which is proposed in some quarters is neither desirable nor feasible. Instead, it is necessary to concentrate on the adoption of essential measures to ensure that their establishment leads to a substantial improvement in standards and raises the output and level of research. It must further be pointed out that the establishment of new universities can be justified only when competent men and physical facilities required for the purpose are available and can be secured and that it would be wrong to create a situation in which there could be an undue dispersal of intellectual talent, funds and administrative ability, all of which are in scarce supply at present. From this point of view, we make the following recommendations:

- (1) No new university should be started unless the agreement of the UGC is obtained and unless adequate funds are provided.
- (2) In many cases it may not be necessary to start a new university. The object in view can be met by developing, under the auspices of a university, one or more postgraduate centres wherever a number of local colleges can make a cooperative effort to provide facilities for postgraduate teaching. This scheme is being tried in some States and the results are encouraging. The university can help to strengthen such centres in many ways. It can depute its

teachers to work for stipulated periods at these centres. It can sanction additional staff for the purpose, if necessary. It can establish a general library for postgraduate students of all the colleges. It can expand existing laboratories or build new ones. It can assist in the construction of additional hostel facilities. In short, an arrangement of this type can secure most of the advantages of a university without throwing on the exchequer all the administrative and other expenses involved in the establishment of a new university. Besides some of these centres could very well meet all the needs of a developing area for some time and thereby prepare the ground for the eventual establishment of a full-fledged university.

- (3) Most of our universities have, and will continue to have, a large number of affiliated colleges. We feel that some experimentation with different types of university organization to deal with this situation would be useful. For instance, a good organization would be one in which a university has a strong core of teaching departments combined with about 30 affiliated colleges situated in close proximity. In such a case, there would be a proper balance between the teaching wing and the affiliated colleges and each could develop without dominating the other. When this balance is upset either by the weakness of the teaching departments or by the overwhelming large number of affiliated colleges, a tension often arises between these two wings and hampers progress. Such a situation should be avoided.
- (4) An experiment which we recommend in this regard is to make some or all the universities in a State join together in a 'consortium', as it were, to operate all the affiliated colleges in the State. This possibility should be explored by the UGC.
- (5) There should be at least one non-affiliating university in each State—unitary or federal.
- (6) We find that the preparation made for the establishment of new universities is, more often than not, perfunctory, and adequate time is not allowed between the passing of the Act and the commencement of the work of the university as such in the sense of admitting students. It would be desirable to set up a convention in this regard that a new university should not be established in a place where a university centre has not been in operation for some time; and that a time of 2-3 years should be allowed to elapse between the appointment of the first vice-chancellor and the commencement of the university's work. During this time, the vice-chancellor should be assisted by a Planning Board which should consider all matters regarding the development

of the university. The valuable pioneering work done in the UK since 1947 in the establishment of new universities can provide useful guidelines in this regard.

- (7) With the large number of universities that have already been established and others that will be during the next 20 years, the problems of university collaboration and cooperation, which have been rather neglected in the past, assume great significance. At the State level, the collaboration of all the universities in the State is essential in matters like research in problems of socio-economic development in the State, the development of the regional language, or relating their output to their manpower need. But such collaboration is even more important at the national level. The universities should join together, at the regional and national levels, in cooperative programmes and supplement mutually their available facilities, especially in research. In fact it should be a constant endeavour of educational policy to treat all universities as national institutions and to build up collaborative and cooperative programmes which cut across State, regional or linguistic frontiers. The promotion of these programmes should be the special responsibility of the UGC.

12.40 *New Central Universities.* One proposal placed before us suggested the establishment of a Central university in every State. In discussions with State Governments and universities, we found that it had a mixed reception: some States welcome it either because a Central university is a prestige institution or because it would thereby be relieved of the financial responsibility, but many oppose it. After careful consideration, we are inclined to agree with the latter view.

12.41 Two main arguments have been put forward in support of the proposal, namely, it will save these universities from local pulls and pressures which are unfavourable to the proper development of higher education and that it will help to raise standards. We are afraid that we cannot accept either of these contentions. Not only one university in a State, but every university has to be protected from unfavourable local pressures and pulls. This, in essence, is the problem of university autonomy which is discussed more fully in the next chapter. We would, however, like to point out that we will have to discover and adopt ways and means, other than 'centralization', for protecting it. Nor can we agree that more liberal assistance from the Centre will necessarily improve standards or that a Central university would *ipso facto* be a better university.

12.42 The main object of this proposal is to ensure a more liberal flow of Central funds to selected universities in the States. We concede

that this is necessary. But instead of selecting one university in each State for this purpose once and for all, it would be better to make more liberal Central assistance available to all State universities on the basis of their performance and merit. This is already being done to a limited extent and the UGC gives developmental grants to these universities. We have recommended larger resources to be placed at the disposal of the UGC so as to increase the amount of Central assistance for developmental purposes. In addition, the amending Bill for the UGC Act proposes to authorize the UGC to give maintenance grants also to the State universities. If these provisions are fully utilized, the main objects of this proposal will be served in a better way and its disadvantages would be avoided. Also, the proposal for the establishment of major universities which we made in Chapter XI partly meets the objects of this proposal.

12.43 *Deemed Universities.* In recent years some of our high-level institutions such as the Indian Agricultural Research Institute at Delhi, the Indian Institute of Science at Bangalore, have been brought into the university system by deeming them as universities under Section 3 of the UGC Act. We consider this a welcome development. There is in our educational system a need for institutions having the academic status and privileges which ordinarily belong to a university, but with more specific and limited functions and scope. While such institutions in their limited field should maintain the highest standard of teaching and research, their organizational set-up need not be the replica of a university. Our recommendation regarding autonomous colleges will be of some use in this context. We would like to stress that, in deeming institutions as universities under the UGC Act, the most careful attention should be paid to the question of educational standards. This provision under the Act gives scope for experimentation and innovation, but it should not become a cheap side- or back-door to university status.

REORGANIZATION OF COURSES

12.44 We shall now turn to a discussion of the general lines on which courses in higher education need to be reorganized. We shall mainly deal with considerations common to courses in arts, commerce and science. The courses in agriculture, engineering and technology are dealt with elsewhere.¹⁴⁹

12.45 *Courses for the First Degree.* The link between the subjects taken

¹⁴⁹ Chapters XIV and XV.

at the school stage and those opted for at the first degree should be less rigid than at present. It is because of this link that specialization starts undesirably early. A student wishing to take physics for his M.Sc., for instance, is now often required to opt for it as early as in class IX. We think that there is no justification for such rigidity and that it should be open to a student to opt for a combination of subjects at the first degree stage, even though some of these may not have been taken by him at the school. Similarly, the combination of subjects permissible for the first degree should be more elastic than is generally the case at present, both in the arts and in the sciences. The subjects which, in the past, seemed to be far apart, are now seen to be much closer and at the higher stages many of the traditional frontiers are breaking down. Therefore, combinations like mathematics and economics or philosophy, physics or chemistry with biology, education or with any other subject, should be permissible. It is true that, by and large, the majority of students would continue to study the subjects they had studied in some depth at the school and that most combinations of subjects will be along traditional lines. But there will be some exceptions to this general principle and the educational system should provide for them.

12.46 The question of general, special and honours courses at the undergraduate stage is of great significance. We define a 'general' course as one in which the student takes three subjects at about the same depth. The 'special' course would be different in kind and provide for the teaching of three subjects of which one would be taken at a much greater depth than the other two. The 'honours' course would be more challenging and require study at a higher level. The general courses should be provided at two levels—pass and honours. The special courses, however, need be provided only at the honours level. In order to economize resources, however, we recommend that

- (1) the universities, which have much better facilities, should only provide for special courses or for general (honours) courses. For them to provide pass courses is to underutilize the resources available;
- (2) the affiliated colleges should, as a rule, have an option to provide either for the general courses—both at the pass and honours level—or the special courses depending upon the availability of teachers and facilities. To economize on costs, however, it may be desirable to prescribe the minimum enrolment needed for the general (honours) and special courses.

12.47 *M.A. Courses in Arts and Science.* There is an urgent need to introduce an element of flexibility and innovation in the organization

of the courses for the Master's degree. Border-line and interdisciplinary subjects are fast becoming areas of major study and research. To bring these into focus in university life, it is necessary to provide, in addition to our present one-subject courses, combination courses consisting of, say, one major subject and one or two subsidiary or related subjects. For instance, universities may provide for various combination courses between education, sociology, philosophy, psychology, economics, law and mathematics. Similarly, it should be possible to combine two modern Indian languages or physics and mathematics, chemistry and mathematics or physics, or physics and life sciences. What is important is to break the present rigidity and uniformity.

12.48 There need be no undue emphasis on the courses for the Master's degree leading to a high level of specialization and research. This should be important but only one of the objectives of the course. It is necessary to design courses with two other equally valid objectives e.g., preparing teachers for schools, and catering for the needs of students who are still interested in broad connected areas and who may attempt specialization later at the Ph.D. level. The postgraduate curricula, therefore, should be so framed that a student can either be introduced to a variety of modern subjects or receive intensive training in one or two special fields. Specialization should be attempted only in cases where facilities exist. Where they do not, universities should aim at providing a general broadbased course so that the student is equipped adequately for undertaking undergraduate teaching and for entering into such other professions as require an advanced knowledge of the subject. Unless the rigidity which characterizes the present-day courses in postgraduate education is reduced, it will not be possible to provide adequately for the needs, aptitudes and abilities of the students.

12.49 *Research Degrees.* As is well known, the standards of research degrees in some universities and in certain subjects are high and comparable to those abroad. But the same cannot be said of many subjects and all universities. A collection of research topics in various science subjects which have been accepted for the award of Ph.D. degree in most universities is a curious mixed bag and if one were to pick at random, one is most likely to meet with a topic which both by its very formulation and by its scope would be considered to be behind the times by at least ten to twenty years. This is partly due to the fact that in most universities the problems are *given to* and *not selected by* the student on the basis of his ability and facilities available for work. The guide generally determines the nature and scope of the problem to be solved by the student. It is true that some of the topics undertaken by students, at least in some universities, belong to the scientific forefront. But, by and large most

of the topics taken up for investigation do not reflect a modern content or approach. With a view to improving the existing situation, we make the following recommendations:

- (1) A student should be expected to work from two to three years for a Ph.D. degree. Its basic objective is to train in research methodology, comprehension of scientific literature, ability to make critical analysis, to draw suitable inferences and to present the findings in a clear, logical and scientific way and to be able to criticize as well as to accept criticism. It should be regarded as the beginning of the real research career of the student rather than as its climax or end.
- (2) Very often, the preparation of students obtaining the Master's degree is not adequate enough to enable them to embark on a research investigation worthy of the Ph.D. degree. It would, therefore, be desirable that candidates entering on the Ph.D. courses should spend the first year partly in advanced training in the subject, requiring attendance at some lectures and tutorials of an advanced nature.
- (3) The students for the Ph.D. courses should be carefully selected. The eligibility of the guides as well as the facilities needed should be carefully specified. There should be a limit on the number of students to be guided by a teacher at any given time; and there should be a time-limit within which the student should be expected to submit his thesis and a similar time-limit for the university to take a decision on it.
- (4) The procedures for evaluation should be improved. While the guide who has supervised the work should be one of the members of the Board of Examiners, no degree should be awarded unless reports of all examiners are unanimously in favour of the proposal. As far as possible, evaluation should be done by Indian experts in the subject. A *viva voce* examination or a defence of the thesis should be considered essential before the degree is recommended.
- (5) A study of a second world language such as Russian, German, or French should be obligatory for all Ph.D. students. It may be desirable to make this compulsory even for the courses for the Master's degree, at least in certain subjects.
- (6) It would also be desirable to institute a higher degree than the Ph.D. in such universities where it does not exist already. This degree, namely, Doctor of Science, representing the highest award should be given mainly on the basis of research work of recognized merit published in international scientific journals and should be scrutinized by a team of scientists both from within

India and outside. It would be desirable to have an interval of at least five years between the award of Ph.D. and D.Sc. degrees.

12.50 *Interdisciplinary Studies.* Special efforts need also to be made to promote interdisciplinary studies in universities which have adequately staffed departments in related subjects. This will need new combinations of subjects, new methods of cooperation between different institutions and new patterns of staffing. The field is vast, but by way of illustration, we may refer to one field: education. For a study of its problems in all their complexity, an interdisciplinary approach is needed between the departments of education, sociology, psychology, comparative religions, economics, public administration and law. Each subject department of a university such as physics, chemistry, or history can work on problems of school curricula and methods in its own field. Courses in education can be combined with courses in most other subjects, both at the undergraduate and postgraduate levels. It is for this reason that we have emphasized the establishment of schools of education in four or five big universities to begin with. Some further details of their working are discussed elsewhere.¹⁵⁰

12.51 To further this objective, a broadbased staffing pattern is also needed. For instance, it would be extremely helpful to have educationists on the staff of a school of sociology just as it is desirable to have sociologists on the staff of a training college. The same conditions, *mutatis mutandis*, apply to other departments.¹⁵¹

12.52 *Study of Social Sciences.* Mainly for historical reasons, the universities and colleges of India have tended to concentrate on the study of languages and humanities and the study of the social sciences, and also behavioural sciences, which are often grouped together within the wider field of the humanities, has generally remained underdeveloped. The only social science which has received adequate attention is economics. Political science has more recently been introduced as a field of study, either as a separate department or in association with history and economics. Sociology and social anthropology are taught in a few universities and geography has been introduced as a subject of advanced study in some others. A number of special and separate institutions that have been established in recent years in this field are evidence of the growth of interest in the social sciences. Much, however, remains to be done and the full importance of the social sciences is yet to be recognized. The present practice of associating the social sciences closely

¹⁵⁰ Vol. I, Chapter IV.

¹⁵¹ The need for interdisciplinary studies in the natural sciences has been discussed in Chapter XVI.

with the humanities, or even of including the social sciences in the wider field of humanities, may be justified historically or on the ground that they all have as a common goal the study and knowledge of Man. But, because of the specific aims of their research and special methods involved, the social sciences are tending to diverge more and more from the humanities. By their recent achievements and their future prospects they must be recognized as an autonomous group of **disciplines**.

12.53 In the course of the last forty years, the social sciences have undergone a tremendous change, less spectacular and less accessible to the general public than natural sciences and technology, but no less deep or extensive. The application of social sciences has brought about important results in the economic and social development of modern societies and even in the policies of governments. They, therefore, find an important place in higher education and research, as well as strong encouragement and financial aid from governments, private organizations and industrial, agricultural or commercial concerns. There is now a tendency to introduce into the curriculum of secondary education, at least at the higher secondary stage, some rudiments of the social sciences and their methods.

12.54 We must admit that, despite remarkable achievements of individual scholars and institutions, the social sciences have not so far obtained in India the place and standing they deserve, due not only to their specific value, but also to their direct use in Indian society and Indian education.

We recommend that the social sciences should be given a significant position in Indian universities and research institutions for the following reasons amongst others:

- (1) Along with the natural sciences, if not to the same extent, the social sciences can be used to create a scientific outlook. Teaching and research in sociology, social psychology, economics and other social sciences, using precise methods such as statistics and other instruments of measurement, can develop in students as well as in teachers, a spirit of accuracy, critical analysis, investigation and experimentation, which any good educational process has the duty to encourage and promote.
- (2) The social sciences are essential tools for the study of the conditions and needs of modern society and, without a proper use of their methods and results, control of economic, social, financial and demographic developments or manpower requirements is impossible. Proper planning, which is important for all countries but especially so for India, needs a larger number of persons with extensive knowledge and training in the social sciences.

- (3) Modern societies need, as they become more industrialized, not only engineers, technicians and skilled workers, but also a large number of well-educated and trained people for what is usually called 'the third sector of the economy': education, public administration, private management, commerce, distribution, communications, information services, etc. Specialists in these fields need good education in the social sciences.

12.55 The recent emphasis on science education has sometimes been blamed for the slow development of social sciences. This is not quite correct. As we have stressed in this Report, this emphasis is essential and will have to be continued. But we visualize only about 30 per cent of the university enrolment doing pure science and an equal proportion doing applied science in the form of professional courses like engineering or medicine. The present trend of over-expanding enrolment in science (with a consequent adverse effect on standards) is to be discouraged. As we visualize it, the proportion of students studying social sciences could be about 30 per cent or almost the same as that of the students of natural sciences. Moreover, we think that there can be no water-tight divisions between these disciplines. The trend in higher education will, in future, be to provide a balanced education for all, i.e., while a student may specialize in any field of his choice in the three major areas of languages and humanities, social sciences, and natural sciences, he will also have some grounding in the other two fields.

12.56 Two main difficulties have to be overcome if social sciences are to grow, viz., they must receive adequate financial support, and they must draw a proper share of the talent available.¹⁵² From this point of view, we recommend that

- there should be adequate provision of scholarships in the social science courses;
- the choice of subjects at the first degree stage should be elastic and it should be possible for students to combine study of a social science with any other group of subjects;
- the financial assistance available to universities for the development of social sciences should be considerably increased; and
- high level schools or Centres of Advanced Study for allied groups of social sciences should be developed in a number of universities.

12.57 *Area Studies.* There is a growing awareness of the value and importance of developing a gradually expanding programme of area studies at suitable centres in the country. India has close social, political

¹⁵² At present, the vast bulk of the talented students opt for engineering and medicine—the most coveted of careers—and we were told in several universities that the quality of students in the social science courses was going down.

and economic relations with several countries and there is a pressing need for a large number of Indian scholars with specialized knowledge of the life, institutions, culture and languages of specific regions of the world, particularly those with which India is directly and more intimately concerned. The establishment of the Institute of Russian Studies, New Delhi, which is intended to promote studies relating to the Soviet Union is a welcome step in this field. The American Studies Research Centre, Hyderabad, provides facilities for the study of American life and culture. The Indian School of International Studies, New Delhi, is a pioneer institution that has embarked on a number of courses relating to the study of various regions. Chinese studies are being developed in the Delhi University. However, there are areas like East Asia, South and South East Asia, West Asia, Africa and Latin America, and countries which are India's immediate neighbours which deserve more attention in our academic programmes than they have hitherto received.

In view of the limited resources available in terms of competent personnel, foreign exchange, etc., it should be our endeavour to develop a significant and effective programme of area studies in a few selected universities and institutions. Such a programme would require intensive courses in the languages of the areas concerned, and the introduction of optional groups of papers in certain social science subjects having reference to the different areas selected for intensive study. Close interdisciplinary collaboration would also be necessary for the programme. Scholars having the right aptitudes may have to be selected for periodical visits to the specific areas or regions. It may also be necessary to invite selected teachers or scholars from foreign countries for short periods.

We understand that the University Grants Commission has appointed a standing advisory committee to develop the programme of area studies in the universities. We hope that steps will be taken to promote this significant programme expeditiously. This is a need which in the present circumstances brooks no delay.

12.58 Study of Humanities. The need for strengthening the humanities cannot be overstressed. In the course of history, the civilization and culture of India have made striking contributions to humanist thought, and the values of our society and the finest traits of our national character are derived from creative studies made in these fields. It would be a sad day if the present preoccupation with science and technology resulted in the neglect of the humanities, which are already starved of talent and resources. In the humanistic studies it is not so much financial resources as the quality of scholars and teachers and the spirit by which they are inspired that count. Such a spirit towards the humanities needs to be nurtured. The best talent in these fields of learning should receive

the same recognition and encouragement as is offered to scientists and technologists.¹⁵³

12.59 While dealing with the programme of science education we have referred to the inevitability of our dependence on developments in advanced countries with which we will not be able to catch up in the foreseeable future. To redress the balance, we like to think that our scholars will make significant contributions to the sum total of human knowledge and experience in the fields of the social and pedagogical sciences and humanistic studies, where our old traditions and the present challenges posed by social developments present unique opportunities for creative work.

EDUCATIONAL RESEARCH

12.60 We have already recommended that education should be treated as a separate discipline at the university level.¹⁵⁴ We shall here discuss some problems relating to the development of educational research.

12.61 Educational research is still in its infancy. Its quantity is small and its quality, mediocre or poor. This is due to several reasons. Most of this research is confined to training colleges which have very inadequate facilities for research and few competent people to guide it. In the absence of specialized institutions doing research on their own, the bulk of research comes to be done by students for the university degrees—M.Ed. and Ph.D. The M.Ed. dissertations hardly deserve to be called research, although they have a useful place as an exercise in training the students in research techniques. At the Ph.D. level, the programme has been weak in methodology and has suffered further because only those students who have done the B.T. or the M.Ed. can be admitted to it. There are very few scholarships available for research students in education. Again, a good deal of the research done so far has been in the field of mental testing and other fields have received but little attention. Ancillary services like documentation, computation, consultation, etc. have not been developed. The country does not have a single journal devoted to educational research. No central clearing house has been created and there has been considerable duplication of work. Even the little research that has been done has largely remained in the archives, and administration has not used its findings for formulation

¹⁵³ Advanced centres in these disciplines should be developed at suitable universities. Special care is to be given to the fostering of studies in the classical languages and literatures, and the high standards achieved in the past in the study of Sanskrit, Arabic and Persian should be maintained and surpassed. The great importance of historical studies needs to be underlined; a free and democratic society striving for national integration and new human values cannot afford to overlook the relevance of history in our times.

¹⁵⁴ Vol. I, Chapter IV.

of policies. The total expenditure on educational research—estimated as less than half a million rupees a year—has been negligible.

12.62 If this picture is to be changed, urgent steps have to be taken to develop educational research and relate it effectively to the formulation of educational policies and improvement of education. From this point of view, we make the following recommendations:

- (1) A documentation centre and a national clearing house in educational research should be developed at the NCERT. We welcome the decision of the Council to start a journal devoted to educational research. In collaboration with this Centre, steps should be taken to organize periodical conferences of research workers so that their isolation is broken and educational research acquires a professional status.
- (2) Educational research has to be developed in teams and in interdisciplinary fields. While all training colleges should do some research, the restriction of educational research to training colleges has hampered its growth. We have recommended earlier that Schools of Education should be established in four or five universities.¹⁵⁵ It will be the special responsibility of these schools to develop educational research in a big way in collaboration with other departments. The other universities also can take up different projects in their own way. We find that, as a rule, the universities have shown little interest in the study of educational problems, even those relating to higher education. For instance, socio-economic studies of their student body can be done by the department of sociology; studies in wastage and stagnation in their courses can be done by the department of mathematics and statistics. But by and large, this is not done. We recommend that universities should make it a point to conduct research in educational problems relating to their own work and, wherever possible, to that of the secondary and primary schools in the neighbourhood. Outside of them, special organizations like the NCERT and the State Institutes of Education will have to develop large programmes of research.
- (3) It is desirable to set up a National Academy of Education consisting of eminent educationists, broadly on the lines of the National Institute of Science, to promote educational thought and research. This should essentially be a non-official, professional body. But it should receive adequate financial support from the Government of India.
- (4) While the NCERT should do research on its own and in collaboration with the State Institutes of Education and run a central

¹⁵⁵ Vol. I, Chapter IV.

clearing house, we do not think it advisable to make it responsible for distribution of grants for educational research to other institutions, especially because we expect the universities and other organizations to enter the field in a big way. This is essentially a responsibility of the Ministry of Education which it should assume. We recommend that a strong Education Research Council should be set up in the Ministry of Education for this purpose. It should be presided over by a professional educationist of distinction and consist of representatives of the universities, training colleges, NCERT, State Institutes of Education, and institutes interested in educational research and some educationists and educational administrators and planners. Its main function would be to distribute funds placed at its disposal for educational research and to bring out periodical reviews of its development for the information of all concerned. It should have a secretariat of its own in the Ministry of Education.

- (5) As time passes, we expect that educational research will become more and more sophisticated. There is, therefore, urgent need to provide good specialized training for research work and services for data-processing, statistical analysis and consultation.
- (6) It would be the responsibility of the NCERT at the national level and the State Institutes of Education at the State level to bridge the serious gap between educational research and current school practices. A similar role will have to be played by the UGC in the field of higher education. It is for them to bring to the notice of the universities, State Education Departments, schools and teachers the new developments in education and the findings of educational research and their implications for the teaching and learning and organization of education.

12.63. The problem of priorities in educational research is complex. Several problems on which research is needed on a priority basis have been indicated in the different parts of this Report. It has to be noted, however, that the priorities in educational research at the national level, from the point of view of the educational planner or administrator, may be very different from similar priorities at lower levels, or from the point of view of teachers. We do not, therefore, think that any rigid framework of priorities need be evolved. It should be left to the different agencies which give research grants or conduct research to decide for themselves the important problems which demand immediate attention. These decisions will be taken by the Education Research Council in the Ministry of Education at the national level, by the State Departments of Education (in consultation with the State Institutes of Education) at the State level and by the universities, training colleges and teachers

interested in research work. The decentralization of initiative in this matter has to be emphasized.

12.64 The total expenditure on educational research has to be increased considerably, the goal being to devote about one per cent of the State expenditure on education to it. This is merely an indication and an expenditure of this magnitude will take some years to be usefully incurred. What is important to note in the immediate future is that no worthwhile project of educational research should be allowed to be shelved for want of financial support.

12.65 It is necessary to bring together officers of the Education Departments working in the field with the research workers in training colleges and the universities. For instance, the schools of education which we have recommended should make it a point to hold annual conferences of selected district education officers, headmasters of schools at all levels and teacher educators. As far as possible, these should be of inter-State character. In these conferences, a two-way process will take place. The field officers of the Education Department can place before the staff of the school of education, the practical difficulties which they come across and to which they can find no solution. On their part, the teachers in the school of education can acquaint the field officers of the Department with the latest findings of research and can take up their problems for future study and investigations. This fruitful combination of field-work with research will have to be greatly emphasized in future, if the innumerable problems that face us in educational development have to be solved quickly and satisfactorily.

SUMMARY

1 *Expansion of Facilities.* The expansion of facilities in higher education should be planned broadly in relation to manpower needs and employment opportunities. On the basis of the present trends, it appears that the enrolments in undergraduate and postgraduate courses will have to be increased from about 1 million in 1965-66 to 4 million in 1985-86. Facilities in professional courses such as agriculture, engineering or medicine and those at the postgraduate stage will have to be specially expanded.

12.02-09

2 *Selective Admission.* Since the demand for higher education will be much larger than the provision that can be made for it or is needed on the basis of manpower needs, a system of selective admissions will have to be adopted. Three measures would have to be adopted from this point of view:

- the determination of the number of places available in an institution in relation to teachers and facilities available to ensure that standards are maintained at an adequate level;
- prescription of eligibility by the universities; and
- selection by the institution concerned of the best students from amongst those who are eligible and seek admission.

(1) While the use of examination marks as a major basis for admissions may continue until better selection methods are devised, their arbitrariness or lack of reliability should be compensated, to the extent possible, by making due allowance for the socio-economic handicaps of students so as to relate selection more directly to innate talent. The final selection should also take into consideration such factors as the school record and the proficiency of the student in fields not tested in the examination. This is especially important in border-line cases. In exceptional cases, the universities should have the right and courage to suspend the rules and give admissions to students whose talent has been identified but who may not have been able to fulfil the entrance requirements. The procedure proposed for selecting students on the basis of 'school clusters' for the award of scholarships may also be adopted for making admissions to quality institutions.

(2) Each university should constitute a Board of University Admissions to advise the university about all matters relating to admissions.

(3) The University Grants Commission should set up a Central Testing Organization for the development of appropriate selection procedures for different courses of higher education.

12.10-20

3 *Part-time Education.* Opportunities for part-time education (correspondence courses, evening colleges) should be extended widely and should include courses in science and technology. By 1986, about a third of the total enrolment in higher education could be provided through a system of correspondence courses and evening colleges. 12.21-22

4 *College Size.* The general policy should be to encourage the establishment of bigger institutions which tend to be more efficient and economic. A college should normally have a minimum enrolment of 500 and it would be preferable to raise it to 1,000 or more in as many colleges as possible. From this point of view

- (1) the UGC should undertake a study of the planning of the location of colleges with special reference to small colleges;
- (2) in granting affiliation to colleges, the universities should emphasize the expansion of existing colleges, rather than establishing new ones;
- (3) in granting affiliation to a new college, care should be taken to see that its location is so planned that it does not interfere with a proper growth of an existing institution of its own. 12.23-26

5 *Postgraduate Education and Research.* Postgraduate education and research work should ordinarily be organized in the universities or in university 'centres' where a good programme can be developed co-operatively by a group of local colleges. The increase in enrolments at the postgraduate stage should always be contingent on adequate increase in material and staff resources. A rigorous test of admission should be introduced and adequate scholarships should be available (to cover 50 per cent of the students) and these should be supplemented by loan scholarships. The Government of India should be made almost exclusively responsible for postgraduate education and research. 12.27-31

6 *Education of Women.* (1) At present, the proportion of women students to men students in higher education is 1 : 4. This should be increased to about 1 : 3 to meet the requirements for educated women in different fields. For this purpose, a programme of scholarships and provision of suitable but economical hostel accommodation should be developed.

(2) At the undergraduate stage, separate colleges for women may be established if there is a local demand. At the postgraduate level, however, there is no justification for separate institutions.

(3) Women students should have free access to courses in arts,

humanities, sciences and technology. Courses in home science, nursing, education and social work need to be developed as these have attraction for a large proportion of girls. Facilities for advanced training in business administration and management should also be provided.

(4) Research units should be set up in one or two universities to deal specifically with women's education. 12.32-34

7 *New Universities.* The establishment of new universities is incapable. The metropolitan cities of Bombay, Calcutta, Delhi and Madras should have, by the end of the Fourth Plan, two universities each which would supplement to some extent the work of each other. The demand from the States of Kerala and Orissa for additional universities is justifiable. The proposals for the establishment of a university for the hill areas of the North-Eastern Region should be supported as a major measure for spearheading economic and social development in the area.

8 In establishing new universities, the following principles should be kept in view:

- (1) The establishment of a new university can be justified only if it leads to a substantial improvement in standards and in the output and level of research.
- (2) No new university should be started unless the agreement of the UGC is obtained and adequate provision of funds is made.
- (3) Cooperative effort by postgraduate centres to provide facilities for postgraduate education should be developed as a first step towards the establishment of a university. A new university should not ordinarily be established in a place where a university centre has not been in operation for some time.
- (4) Good university organization would be one in which a university has a strong core of teaching departments combined with about 30 affiliated colleges in close proximity.
- (5) The UGC may explore the possibility of bringing together all universities in a State in a 'consortium' to operate all the affiliated colleges in the State.
- (6) A time of two to three years should be allowed to elapse between the appointment of the first vice-chancellor and the direct commencement of the university's work, the vice-chancellor being assisted by a Planning Board during the period.
- (7) Larger resources should be placed at the disposal of the UGC so as to increase the amount of Central assistance to all State universities on the basis of their performance and merit.

12.35-45

9 *Calcutta University*. The State Government in consultation with the UGC and the Government of India may have the affairs of the University of Calcutta examined with a view to finding a way out of the difficulties created by a rapidly increasing undergraduate population. 12.36

10 *Inter-University Collaboration*. Universities should join together, at the regional and national levels, in cooperative programmes and supplement mutually their available facilities, especially in research. It should be the special responsibility of the UGC to promote collaborative and cooperative programmes which cut across State, regional or linguistic frontiers. 12.39

11 *Reorganization of Courses*. (1) The combination of subjects permissible for the first degree should also be more elastic than at present, both in the arts and in the sciences. It should not be linked too rigidly to the subjects studied at school.

(2) There should be general, special and honours courses at the undergraduate stage. Universities which have better facilities should only provide for special courses or for general (honours) courses. Affiliated colleges should have an option to provide either the general courses—both at the pass and honours level—or the special courses, minimum enrolment being prescribed for the general (honours) and special courses to economize on costs.

(3) It is an urgent need to introduce flexibility and innovation in the organization of the courses for the Master's degree. The curricula should be so framed as to provide a general broad-based course or intensive training in one or two special fields.

(4) A student should be expected to work from two to three years for a Ph.D. degree which should be regarded as the beginning and not the climax of the research career of the student. During the first year of the Ph.D. course, students should attend lectures and tutorials of an advance nature to overcome inadequacy of preparation at the Master's degree stage.

(5) Students for the Ph.D. courses should be carefully selected, a time-limit being set within which a student is expected to submit his thesis. There should also be a limit on the number of students to be guided by a teacher at any given time.

(6) The procedure for evaluation of the Ph.D. degree should be improved, a defence of the thesis being considered an essential requirement for the degree.

(7) A study of a second world language should be obligatory for all

Ph.D. students and compulsory for the Master's degree in certain subjects.

(8) It would be desirable to institute the degree of Doctor of Science as the highest award given on the basis of recognized research work.

(9) Special efforts should be made to promote interdisciplinary studies in universities which have adequately staffed departments in related subjects. To further this objective, a broad-based staffing pattern is also needed. 12.44-51

12 *The Social Sciences.* The social sciences should be given a significant position in Indian universities and research institutions. From this point of view

- there should be adequate provision of scholarships in the social science courses;
- the choice of subjects at the first degree stage should be elastic and it should be possible for students to combine study of a social science with any other group of subjects;
- the financial assistance available to universities for the development of social sciences should be considerably increased; and
- high level schools or Centres of Advanced Study for allied groups of social sciences should be developed in a number of universities. 12.52-56

13 *Area Studies.* It should be our endeavour to develop a significant and effective programme of area studies in a few selected universities and institutions. Such a programme would require intensive courses in the languages of the areas concerned, and the introduction of optional groups of papers in certain social science subjects having reference to the different areas selected for intensive study. Close interdisciplinary collaboration would also be necessary. 12.57

14 *Study of Humanities.* The need for strengthening the humanities cannot be overstressed. In science education, we shall have to depend inevitably on developments in advanced countries with which we will not be able to catch up in the foreseeable future. To redress the balance, our scholars should strive to make significant contributions to the sum total of human knowledge and experience in the fields of the social and pedagogical sciences and humanistic studies, where our old traditions and the present challenges posed by social development present unique opportunities for creative work. 12.58-59

15 *Educational Research.* Urgent steps have to be taken to develop educational research and relate it effectively to the formulation of

educational policies and improvement of education. From this point of view, the following programmes need to be developed.

(1) A documentation centre and a national clearing house in educational research should be developed at the NCERT.

(2) Educational research has to be developed in teams and in interdisciplinary fields. While all training colleges should do some research, the restriction of educational research to training colleges has hampered its growth. It will be the special responsibility of Schools of Education to develop educational research in a big way in collaboration with other departments.

(3) It is desirable to set up a National Academy of Education consisting of eminent educationists, broadly on the lines of the National Institute of Science, to promote educational thought and research. This should essentially be a non-official, professional body. But it should receive adequate financial support from the Government of India.

(4) An Education Research Council should be set up in the Ministry of Education for the promotion of research.

(5) There is urgent need to provide good specialized training for research work and services for data-processing, statistical analysis and consultation.

(6) It would be the responsibility of the NCERT at the national level and the State Institutes of Education at the State level to bridge the serious gap between the educational research and current school practices. A similar role will have to be played by the UGC in the field of higher education.

(7) The total expenditure on educational research has to be increased considerably, the goal being to devote about one per cent of the State expenditure on education to it.

12.60-65

CHAPTER XIII

THE GOVERNANCE OF UNIVERSITIES

13.01 Universities in the modern world have a multiplicity of functions, the most important of which are *teaching*, *research*, and *extension* involving direct contact with the community. Their enrolments, staff and budgets are becoming increasingly large and they are required to assume new functions and programmes. The problems of the internal government of universities and other institutions of higher education and of their relationship with the State are, therefore, becoming increasingly important and complex. We devote this chapter to the consideration of some important issues relating to the constitution and organization of universities, the management of university affairs, autonomy and academic freedom and related matters.

13.02 One preliminary observation may be made. There are some principles of governance (such as the maintenance of a clear chain of responsibility, delegation of functions and authority, insistence on economy and efficiency) which are common to all good organizations. But there are others which depend upon the nature of work and specific purpose of the organization. The character of a university as a society of teachers and students engaged in the pursuit of learning and discovery distinguishes fundamentally the regulation of its affairs from, say, the profit-motivated management of commercial or industrial concerns or the administration of a government department, a municipal corporation, or a unit of the armed forces. Unfortunately, the problems special to university governance have not received adequate attention and universities in our country often tend to rely heavily on governmental rules and practices. What is worse, rules, procedures and techniques once adopted tend to be continued indefinitely in their original form even when changed conditions and circumstances have made them obsolete or incompatible with the real needs and interests of the institutions. Such rigidity seriously retards progress and development. A resolute effort needs to be made to evolve policies, techniques and practices, and a machinery for decision-making needed for a forward-looking and dynamic academic organization. Rules, regulations and techniques that hamper achievement of the real purposes of the university should be modified or scrapped—they should not be allowed to become straight-jackets into which all university activities must be fitted. It would be of real value if in some selected

universities, groups of interested and knowledgeable persons, academic and administrative, could join hands to study seriously problems of academic government and administration, and suggest ways and means to bring about a radical improvement in the present somewhat chaotic situation. We recommend that the UGC should encourage the formation of such groups. It may also be desirable if, in a few selected universities, certain concerned departments like those of education, science, public administration and law can join hands to study the problems of educational administration and management of university affairs.

UNIVERSITY AUTONOMY

13.03 *The Concept of University Autonomy.* To begin with, a distinction needs to be made between university autonomy and academic freedom of university and college teachers. This freedom implies that a teacher cannot be ordered or required to teach something which goes against his conscience or conflicts with his conception of truth. In this context, we would also like to emphasize the freedom of teachers to hold and express their views, however radical, within the classroom (and outside) provided they are careful to present the different aspects of a problem without confusing teaching with 'propaganda' in favour of their own particular views. A teacher should be free to pursue and publish his studies and research; and speak and write about and participate in debates on significant national and international issues. He should receive all facilities and encouragement in his work, teaching and research, even when his views and approach be in opposition to those of his seniors and the head of his department or faculty.

13.04 In theory there is no serious restriction or curtailment of academic freedom, but we would like to see teachers practising more of it and vigorously. In fact, it is an inherent obligation of the academic community to play an active and positive role in critical examination, evaluation and evolution of concepts and policies over the entire spectrum of the society's concern and involvement. The universities have a major responsibility towards the promotion and development of an *intellectual climate* in the country which is conducive to the pursuit of scholarship and excellence, and which encourages criticism, ruthless and unsparing but informal and constructive. All this demands that teachers exercise their academic freedom in good measure, enthusiastically and wisely.

13.05 The proper sphere of university autonomy lies principally in three fields:

- the selection of students;
- the appointment and promotion of teachers;

- the determination of courses of study, methods of teaching, and the selection of areas and problems of research.

13.06 In the use of its autonomy, the universities will gradually win not only self-respect but the respect of society and government and play their proper role in national life. There is then a likelihood that the universities should be governed by one overriding consideration—their commitment to truth in all fields of activity. This passion for truth must be inculcated in some measure in all their members and there should be some who are wholly dominated by it and find in it their real fulfilment.

13.07 It is important to recognize that the case for autonomy of universities rests on the fundamental consideration that, without it, universities cannot discharge effectively their principal functions of teaching, research and service to the community; and that only an autonomous institution, free from regimentation of ideas and pressure of party or power politics, can pursue truth fearlessly and build up, in its teachers and students, habits of independent thinking and a spirit of enquiry unfettered by the limitations and prejudices of the near and the immediate which is so essential for the development of a free society.

As Bertrand Russell has observed: 'Where independent thinking dies out, whether from lack of courage or absence of discipline, there the evil weeds of propaganda and authoritarianism proliferate unchecked. The stifling of criticism is thus a much more serious thing than many people realise. Far from creating a living unity of purpose in a society, it imposes a kind of insipid, brittle uniformity upon the body politic. It is a pity that men in places of power and responsibility are not more often aware of this.'¹⁵⁸

13.08 In considering the question of university autonomy, we must recognize three (somewhat overlapping) levels at which it functions:

- (1) autonomy within a university, e.g., autonomy of the departments, colleges, teachers and students in relation to the university as a whole;
- (2) autonomy of a university in relation to the university system as a whole, e.g., the autonomy of one university in relation to another, or in relation to the UGC and the Inter-University Board (IUB); and
- (3) autonomy of the university system as a whole, including the UGC and the IUB, in relation to agencies and influences emanating outside that system, the most important of which are the Central and the State Governments.

¹⁵⁸ Bertrand Russell, *Wisdom of the West*, Doubleday Garden City, New York, 1959.

13.09 *Autonomy within a University.* Before considering the relations between individual universities and of the university system as a whole with external authorities, it would be desirable to discuss briefly the meaning of autonomy within the university itself.

(1) It is recognized that the representation of lay elements on the various governing bodies of the university is necessary and justified in view of the nature of relationship between the university and the society. It would, however, be contrary to the principle of university autonomy if the lay or non-academic members in these bodies assume a dominating and controlling position. Conventions should be developed which would largely shift the centre of gravity of authority to the academic wing of the university's government. In particular, care should be taken to see that the Academic Council is vested with the final authority in all academic matters. The function of the non-academic element should be mainly to present to the academics the wider interests of the society as a whole, but not to impose them; it should also serve to represent the views and interests of the academics to the wider society and thus make the smooth functioning of the university more easily possible.

(2) It is necessary to ensure that universities do not become administration or administrator dominated and to keep vigilant in this regard. The dominance, if one is to use that word at all, must be of the academic element, and the principal function of the administration is to serve the academic interests of the university.

(3) In the governance of a university, the principle that good ideas often originate at the lower levels of the hierarchy must be recognized and respected. The tendency to attach importance to ideas and proposals merely because they emanate from persons who happen to hold important positions is unhealthy and particularly out of place in a university where they must be judged objectively and on their intrinsic merit. As Sir Eric Ashby has observed: 'This principle of upward flow is vital to the efficient administration of a university and for the survival of autonomy and self-government. . . . Not all professors consult their lecturers before decisions are taken as scrupulously as they themselves expect to be consulted by the lay governors in similar circumstances. As faculty boards become larger, there is a temptation for an oligarchy of senior professors to take over the responsibilities of government on behalf of their more junior colleagues. That way danger lies, for any weakening of the principle of self-government within the academic body makes it harder to preserve self-government within the university as a whole and correspondingly harder to maintain the autonomy of the university in the modern democratic state.'¹⁵⁷

¹⁵⁷ Sir Eric Ashby, *Technology and the Academics*, St. Marbins, New York, 1958, p. 196.

(4) The departments of a university are its main operational units on the academic side. We are of the view that wider administrative and financial powers should be delegated to them. Each department should have a Committee of Management under the chairmanship of the head of the department consisting of all professors and some readers and lecturers elected by the staff. It should meet at least once a term to discuss the academic programme of the department, the requirements of laboratories and library, the delegation of duties and related matters, and its proceedings should be circulated to the Faculty and the Academic Council. It will be necessary to provide adequate secretarial assistance to each department for the purpose. In the case of large science departments, it may be advisable to appoint a deputy to the head of the department from amongst the professors or readers. He should be assigned specific functions by the head of the department with the approval of the University Executive Council.

(5) It is essential to recognize the freedom and autonomy of colleges. Our proposals for this will provide, subject to certain conditions and safeguards, greater freedom to colleges and result ultimately in the creation of autonomous institutions. They have been discussed more fully elsewhere.¹⁵⁸

(6) The university should be visualized as an integrated community in which the teachers are, as it were, 'senior scholars', the students are 'junior scholars' and the administration is a service agency to both. All attempts at polarization between teachers, students or administration should be avoided. We recommend the establishment of joint committees of teachers and students in each department and in every college to serve as a forum for the discussion and, where possible, for the solution of common problems and difficulties. The head of the institution—the vice-chancellor or principal—should be kept fully in touch with the work of the committees. In addition, there should be a central committee for the purpose under the chairmanship of the head of the institution consisting of some representatives of staff and students. A machinery of this type, if properly worked, would at least be able to find an adequate solution to the large number of small, easily remediable problems which, for want of due attention at the proper moment, often simmer into bitterness and later engender serious breaches of discipline. It will also, we hope, create better relations and develop a new sense of confidence between the teachers and the students.

(7) As one positive step to encourage students to take part in university government and to make them realize their responsibilities in the day-to-day functioning of the university, we recommend that representatives of the student community (including undergraduate students)

¹⁵⁸ Chapter XI.

should be associated with the Academic Councils and the Courts of the universities. In some universities in Europe and elsewhere, students are members of the Executive Council also.

13.10 *Autonomy within the University System.* It is implicit in the concept of autonomy, and desirable even otherwise, that every university should be entitled automatically to the membership of the IUB. The degrees conferred by a university should also be automatically 'recognized' by every other university in the country.¹⁵⁹ Further, a certain measure of division of labour among universities is necessary, and this applies more to some fields of study than others. In specialized areas like Chinese studies or nuclear physics or oceanography or astrophysics, where equipment is very expensive or qualified manpower scarce, the autonomy of each university to teach and to do research is naturally not absolute and must be modified in favour of some reasonable cooperative arrangement amongst them. The universities can initiate such division of labour, which is the only sensible way of dealing with the phenomenal increase in knowledge and specialization, either on their own or in consultation with the UGC, where necessary.

13.11 *Autonomy in Relation to Outside Agencies.* While universities must have this autonomy, it should be interpreted in the larger context of their obligation and responsibility to the nation and to mankind as a whole. For instance, the national needs for trained manpower have implications for the teaching functions of the universities; and similarly decisions about research which, in a way, must be taken primarily by the universities, cannot be taken in isolation from the economic and social needs of the country which must influence them in a large measure. Such decisions are national decisions in which the competing claims of different sectors of the society must be weighed against one another and in which long-range programmes must be balanced against immediate needs. It is apparent that the conduct of university affairs cannot be left *solely* to the academics; their relationship to social needs requires the admission of non-academic persons within the machinery of their government. The universities have thus to share their decisions with lay agencies or authorities outside the system just as they have to share them with one another or with organizations within the university system itself such as the University Grants Commission and the Inter-University Board. It is particularly in such problems that issues of university autonomy have to be handled with great skill and imagination and it becomes necessary to develop attitudes and conventions

¹⁵⁹ See paragraphs 13.64 and 13.65 *supra* for details.

which will do justice to university autonomy as well as to the valid claims of society.

13.12 We give below some illustrations of the manner in which problems of this type can be handled.

(1) The admission of students is obviously an important aspect of university autonomy. But in the larger interests of society, regulations have to be framed for reserving some seats for under-developed social groups such as the scheduled tribes or the scheduled castes. Even in such cases, however, the discretion of the universities to judge the merits of the individual students should not be fettered; they should be able to select the best students from among the applicants within the underprivileged groups and, if necessary, to refuse admission. In some cases, a cooperative machinery for admissions has to be set up for a number of educational institutions, including those conducted by universities, e.g., in technical colleges where admissions are normally made on a selective basis. The participation of universities in such an arrangement for educational and administrative reasons is justified and cannot be regarded as an infringement of autonomy.

(2) Important problems of coordination arise with regard to national needs for trained manpower. We have recommended earlier¹⁶⁰ that estimates of manpower needs with regard to trained graduates in different fields such as agriculture, engineering, medicine, or teaching, should be prepared and the total output of the universities in the various faculties planned accordingly. This will necessarily imply that the development policies of the universities should be adequately coordinated to meet all the national requirements for trained manpower and steps should be taken to see that, so far as it is predictable, there is no over-production or shortfall in any sector. The decisions in such matters will, however, have to be joint decisions taken after adequate consultation. Since, in the last analysis, the implementation of these plans will be in the hands of the universities, Government must be persuasive and not lay down the law.

(3) Similar problems arise also with regard to research. When it is decided that the economic needs of the society require applied research on particular problems—decisions which must be made, in large part, outside the university—the universities must share the responsibility for it to some extent at least. They have, however, the right to insist that adequate resources for the purposes be provided so that standards of research are not compromised by following any short-sighted policies.

13.13 In matters relating to the national needs for trained manpower and research, an individual university should have the freedom to

¹⁶⁰ Vol. I, Chapter V.

decide whether it will or will not participate and also to determine the extent of its participation, consistent with its other basic objectives. But the university system as a whole must meet the challenge of the situation. For this purpose, a suitable machinery for consultations should be developed between the universities, the representatives of university interests such as the UGC and the IUB and the representatives of Government Departments, both at the Centre and in the States. In the working of this consultative machinery, procedures and conventions should be developed for reaching decisions regarding numbers to be trained, courses of study, and problems of applied research. The most important element in these conventions should be a common appreciation that every task to be undertaken by a university must be carried out at the standard necessary and that the capacity of the universities to teach and to do research is not diminished as a result of the decisions taken. If, for instance, in preparing high-level technical and medical personnel, the universities are asked to increase their enrolments suddenly without providing adequate facilities, it is not merely the universities that suffer but also the quality of the training which is essential for such personnel.

13.14 While instances of the type mentioned above indicate legitimate claims on the universities, there could be other claims or situations which involve an undesirable infringement of university autonomy. For instance, it would be wrong if universities were expected to owe allegiance to any particular political party, or individual, or attempted to further the interests of such parties or individuals. It is equally wrong, as people in power in public life and even those within the academic community itself sometimes do, to influence appointments for teaching or research posts and to interfere with the admission of students in general or of particular students to particular courses. Similarly, it is not proper that State Governments should try to give 'directives' to universities in academic matters such as affiliation of colleges. We also feel unhappy at restrictions placed on some of the universities in the country and at some recent attempts to curtail their autonomy. For instance, the universities in Bihar do not have the authority to recruit their teachers—this is done by the Public Service Commission of the State. There may possibly be good reasons for this decision. All the same, we are strongly of the view that the machinery for the eradication of any deficiencies in a university should be built into the university system itself. There have also been some other instances of the infringement on autonomy, although good sense has ultimately prevailed and led to their modification. For instance, an ordinance vesting the authority to recruit university teachers in the Public Service Commission of the State was issued some time ago by the Government of Madhya

Pradesh. Mention may also be made of the order issued by the Government of Uttar Pradesh defining the qualifications of teachers to be appointed in the Universities of Allahabad and Lucknow, or the recent amendments carried out to its University Acts by the Government of Andhra Pradesh. We are, however, happy to note that the need for effective university autonomy as fundamental to a proper functioning of the universities is, on the whole, widely recognized in the country. In recent years, adverse legislation or orders have been either suitably modified or abandoned in view of the expression of public opinion and the advice given by the Inter-University Board and the UGC. The general trend is in the direction of acknowledging the proper sphere of university freedom and autonomy. We would like to stress that one of the most important functions of the UGC is to support and strengthen the autonomy of the universities and this role will become all the more important, difficult and delicate, as public funds spent on universities increase rapidly and inevitably in the years to come. The present serious difficulties of the UGC in the UK provide a pertinent and useful lesson for all countries which have a UGC-type of organization to pass on to the universities government funds but filter out government control.

13.15 In this connection we would like to draw attention to two important points:

- (1) As in the case of liberty, the price of autonomy is eternal vigilance by all parties concerned. The universities are established by law and they can have only as much autonomy as the law permits. In the last analysis, therefore, the real custodian of university autonomy is public opinion based on a conviction that autonomous universities, which maintain intellectual integrity in their fearless pursuit of truth, are an indispensable bulwark of democracy and freedom. In creating a strong public opinion in this behalf, the UGC, the IUB and the intelligentsia, who are themselves mostly the alumni of the universities, have an important role to play.
- (2) The universities should also realize that it would be unwise to expect that effective autonomy could descend as a 'gift' from above: it has to be continually earned and deserved. The universities derive their right to autonomy from their dedication to the pursuit and service of truth. Their capacity to resist any illegitimate claims on their autonomy, therefore, will be proportional to their effective performance of this duty and their willing acknowledgement of the legitimate claims on them of the non-academic authorities. Moreover, as they discharge their intellectual and public obligations effectively and with integrity and

contribute to the economic and social progress of the country, they will earn the esteem of society and government and the chances of their being confronted with illegitimate claims and pressures from outside will be diminished. This is not an easy task, quick of achievement, but this is emphatically the line along which we should move.¹⁸¹

UNIVERSITY FINANCES

13.16 University autonomy cannot become real and effective unless adequate provision is made to meet the financial requirements of universities and colleges. While the UGC has been established as an autonomous body to provide the necessary financial resources to the universities without governmental control or interference, State universities have to depend, for their maintenance grants and matching share, on the funds provided directly by the State Governments. This is an important source through which they can and sometimes do seek to curb the freedom of the universities. This is obviously undesirable. We recommend that the existing system of university finances should be reorganized on the basis of the following important principles:

- State Governments should deal with the universities with understanding and imagination and place adequate financial resources at their disposal to enable them to carry out their obligations in an efficient way. It would also be desirable if they seek the advice of the UGC in the matter.
- While some safeguards are inevitable in financial matters and reasonable economy in expenditure has to be ensured, it is essential to simplify rules and regulations and to operate them with speed and efficiency.

13.17 The Central universities obtain their grants—for maintenance as well as development—from the UGC. In their case, therefore, difficulties are reduced to the minimum and arise mainly from the inadequacy of available funds rather than through procedural deficiencies. Several difficult problems have, however, arisen with regard to the State universities, and it is these that we propose to discuss in some detail.

13.18 *UGC Grants to State Universities.* The State universities obtain their development grants mainly through the UGC. Under the Bill

¹⁸¹ At the end of the chapter, we give the statement on University autonomy issued recently by the IUB. We fully agree with the views expressed therein.

now before Parliament, the UGC will also be authorized to give maintenance grants to State universities in its discretion. We welcome this **important reform.** c1

13.19 At present, the UGC appoints visiting committees to assess the needs and requirements of the universities for developmental projects during a plan period and sanctions grants-in-aid on the basis of the recommendations made by the committees. This is a good procedure and should continue with certain modifications which we shall discuss a little later. There is room, in our opinion, for expediting the sanction of grants—there are sometimes considerable delays as, for instance, when the All India Council for Technical Education (AICTE) has to be consulted—and for modifying the procedures for the release of funds. But these are, on the whole, of a minor character and we **trust that they will be looked into.**

13.20 For some schemes, the UGC gives grants-in-aid to State universities on a 100 per cent basis. But a majority of the schemes of development require matching grants from the State Governments. These are not often received in time. There is also a tendency on the part of some States to earmark funds for the setting up of new colleges and even new universities rather than to strengthen the standards of existing institutions. In view of these difficulties, it is sometimes suggested that the UGC should give grants on a 100 per cent basis only and that, if necessary, it may even reduce the number of schemes to be assisted. We do not favour this proposal which would have the disadvantage of reducing the total resources available for the development of university education. It may also possibly result in some State Governments taking less interest in higher education which is one of their important concerns. We are, therefore, of the view that there should be some sharing of developmental expenditure on universities between the UGC and the State Governments. But, in view of the financial difficulties which are being experienced by the State Governments, we are of the opinion that the share expected of them should be **reduced to the extent possible.**

13.21 Difficulties have arisen in some universities because the State Governments are not prepared to provide for the committed expenditure arising out of the developmental programmes undertaken by them with assistance from the UGC. In some cases, the State Governments have argued that they were not consulted when the developmental programmes were originally undertaken and that they are, therefore, under no obligation to provide for the committed expenditure involved. These problems have to be solved at an early date in the interest of higher education. We, therefore, recommend that the UGC should take early steps to mediate in the matter and save these universities

from the embarrassment caused by the non-payment of grants on committed expenditure by the State Governments.

13.22 *Grants-in-Aid to the State Universities from State Governments.* The State universities have to obtain grants from their State Governments for three purposes: (1) matching share on developmental grants given by the UGC; (2) non-plan grants for university development; and (3) grants for committed expenditure. The first of these is a small amount and we have recommended above that it may be reduced further. We trust that, in future, there will be no difficulty for the State Governments in making available promptly their matching share for development purposes.

13.23 The non-plan grant for university development as well as grants for committed expenditure, taken together, form a large amount and constitute the bulk of the total financial resources available to the universities. The existing procedures with regard to these grants are not satisfactory and because of them, most State universities are facing severe financial difficulties at present. With a view to making a closer study of the problem, the Commission addressed a questionnaire to all universities for information regarding the present systems of grant-in-aid and the difficulties encountered. The following are some of the main conclusions which have emerged from this study:

- (1) There are two main systems of grant-in-aid from the State Governments to the universities: the deficit grant; and the block grant which may be statutory, *ad hoc* or based on the past expenditure (with or without an allowance for normal expansion).
- (2) Under the system of deficit grants, the annual maintenance grant is given on the basis of the estimated approved expenditure *minus* the estimated approved income, subject to adjustment in subsequent years on the basis of actual income and actual expenditure as revealed by audited accounts. While this sounds unobjectionable on paper, it creates several problems in practice. For instance, the State Government may not convey the approval of its budget to the university in time. In fact, it is sometimes conveyed after six or seven months of the year have elapsed. Sometimes, sudden cuts are made in the budget which create serious difficulties for the university. Under such an arrangement, the university cannot create even a minor post or incur any recurring liability, however small, without the prior approval of the Government. The final adjustment of grants usually takes years to be completed.
- (3) The system of block grant, on the whole, works better, although several problems arise in this method also. The two main ingre-

dients of a block grant are: (a) the basis on which its amount is fixed; and (b) the frequency of revision. With regard to the first, three methods are in vogue. In the first, the amount of the grant is fixed on the basis of past expenditure. The main difficulty in this method is that it does not allow even for the normal growth of expenditure in a university. The practice prevailing in some States of allowing a cushion or an automatic increase at a specified percentage in the block grant is more helpful. But even here difficulties arise when unforeseen decisions have to be taken (such as the revision of salaries or dearness allowance) during the period of the grant. With regard to the second, it is found that there are considerable variations in practice. When the amount of block grants is specified in the university Act itself and is made statutory, the system becomes inelastic, the grants remain fixed for years and the development of universities is retarded. The non-statutory block grants are revised sometimes triennially and sometimes quinquennially. But in a majority of cases, they remain unchanged for much longer periods.

13.24 For the smooth development of higher education it is essential to review these practices and to institute a better system of grant-in-aid. This must satisfy three essential conditions: first, it is necessary to ensure that the grant-giving authority does not exercise too much control and rigidity of approach, as a system of checks and balances—devised in other days for other purposes—is out of tune with the needs of a rapidly developing university administration and finance; secondly, the grant-receiving bodies have to exercise the utmost vigilance and economy in utilising public funds; thirdly, the system should be sufficiently elastic and should leave some scope to the universities to experiment with new ideas and projects. Thus a system of grant-in-aid has to be devised which would promote a free flow of funds from one authority to another and at the same time ensure economy, efficiency and allow for the necessary degree of flexibility.

13.25 In the light of these general principles, we recommend that the system of grant-in-aid from the State Governments to the universities should be reorganized on the basis of a system of block grants providing for:

- fixation of a block grant for a short period, say 3 to 5 years, on a rolling basis;
- provision for inevitable increases of expenditure during the period of grant;
- payment of special grants during this period for unforeseen developments; and

— a 'cushion' to be left to the discretion of the universities so that they can have a fund on which they can freely operate. One way of providing a part of this cushion would be to take into consideration only the 'standard' fees, the cushion consisting partly of the difference between the standard and the actual fees. For the same purpose, we recommend that the interest on endowments should not be taken into consideration while fixing the grant.

The details of the scheme may be worked out by the State Governments in consultation with the universities concerned and the UGC. We understand that the principle of block grants has already been accepted in the case of Central universities and is working satisfactorily. This system could be the basis on which the State Governments work out their own formula.

13.26 University finances have to be considered as a whole and the distinction between the matching share on developmental expenditure, non-plan grants or grants for committed expenditure is purely notional and arbitrary. As it is urgent to place the finances of universities on a sound footing, the UGC should periodically review the finances of each university and give necessary advice in this matter to the State Governments as well as to the universities.

13.27 *Financial Accountability.* A question of considerable importance is the accountability of universities to the legislature as regards proper utilization of public funds made available to them. The present position is that, leaving aside one or two universities, the universities' Acts require that accounts be audited by government auditors; but according to the present practice, they are not placed before Parliament in the case of Central universities or State legislatures in the case of State universities. The Public Accounts Committee of Parliament has from time to time expressed the view that this arrangement is not satisfactory. In its 42nd (1961-62) Report, it has observed that while the Committee is anxious to preserve the financial autonomy of the Central universities, it is unable to share the apprehension that presentation of these audited reports to Parliament would infringe on their financial autonomy or result in making their financial affairs a matter of public controversy. The Committee has urged that early steps should be taken by the Government to present these reports to Parliament and that provision to this effect be made in the statutes.

13.28 We have given careful thought to this matter. It is our view that universities should not only be immune from direct governmental intervention but also from *direct* public accountability. In the interest of the autonomy of the universities, their financial affairs should not be made either a subject of public controversy or an issue in party

politics which is likely to be the case if they are placed before Parliament. Secondly, control over universities should be indirect and in keeping with their position in the national life. In the UK, a closer control of capital expenditure in the universities by Parliament has been the subject of long discussion, but the government has maintained that such control would be detrimental to the independence of the universities.

13.29 There exists a provision in the Acts of Central universities that their audited accounts should be published in the Gazette of India and presented to the Visitor along with the audit report. This procedure gives the Government the necessary opportunity for exercising such corrective and supervisory control over these universities on behalf of the Visitor as is needed, without unduly interfering with their fiscal and administrative freedom. A similar procedure could be adopted for the State universities where it does not already exist.

13.30 The accounts of the universities are generally audited by the Comptroller and Auditor-General who can bring significant points to the notice of the legislature. However, as a safeguard, a specific direction could be given to him that, wherever necessary, serious irregularities in the accounts of the universities should be brought to the notice of the legislature.

13.31 The matter is a complex one and has some far-reaching implications. It is still under the consideration of the Government and the Public Accounts Committee. It will be relevant to reproduce at some length the observations made by the Committee on Higher Education in the United Kingdom in this matter:

We now come to a point of some technicality that has a considerable bearing on academic freedom.

The terms of the Vote under which moneys are provided for the universities and colleges state that grants to institutions will be made on the recommendation of the University Grants Committee; and convention has established that the Treasury does not inquire into or question the Committee's recommendations as to the allocation between universities of the total amounts on which the Government has decided. Again, the Comptroller and Auditor General has not had access to the books of the universities and the University Grants Committee. No doubt having in mind the large proportion of current expenditure represented by academic salaries, which follow prescribed scales, the Public Accounts Committee has hitherto been satisfied that the methods of control of recurrent grants are a reasonable compromise between the need to maintain university independence and the exercise of financial control by the Government and Parliament. But the closer control of capital expenditure was for long the subject

of discussion between the Public Accounts Committee and the Treasury, the former claiming the right of scrutiny, the latter arguing that it would be inimical to the independence of the universities. In recent years, however, procedures have been introduced whereby, without the Treasury or scrutiny from the officers of the Comptroller and Auditor-General, it has been possible to satisfy the Public Accounts Committee that there exist due safeguards against improper or wasteful expenditure, a notable victory for the good sense and moderation of all the parties concerned.

We attach great importance to this immunity and we are glad the Treasury has successfully upheld it. We yield to no one in our condemnation of extravagance in the use of public money and the absence of proper accounting, and we think it perfectly proper that the Grants Committee should have the right to adopt such safeguards as are necessary to prevent abuses of this kind. But unless full confidence is placed in the Committee, rather than in a ministerial department, to exercise these functions, an important part at least of its value as a buffer disappears, and the way is open to intervention by the Government and Parliament in the work of the universities. Our travels abroad have convinced us more than ever of the immense value of the British system whereby detailed public justification of particular university expenditure is not required. It was the Rector of one of the most famous universities in Western Europe who said, when describing to us the system under which he worked, 'so long as we are subject to these controls as regards finance, all talk of academic freedom is a swindle'. We recommend, therefore, that, irrespective of any changes in ministerial responsibility, present policy on accountability should continue.

There will remain matters of broad policy on higher education that must be the concern of the Government and of Parliament, and it is the great advantage of the Grants Committee principle that in all such matters the views and advice of the Government and universities can be mutually brought to bear without detailed scrutiny of the expenditure of particular institutions. This, as experience elsewhere shows, is incompatible with that free initiative and full responsibility that it is in the national interest to preserve.¹⁶³

ROLE AND APPOINTMENT OF THE VICE-CHANCELLOR

13.32 The person who is expected, above all, to embody the spirit of academic freedom and the principles of good management in a univer-

¹⁶³ *Report of the Committee on Higher Education, U.K., H.M.S.O., London, 1963, paragraphs 752-756.*

sity is the vice-chancellor. He stands for the commitment of the university to scholarship and pursuit of truth and can ensure that the executive wing of the university is used to assist the academic community in all its activities. His selection should, therefore, be governed by this overall consideration.

13.33 The University Education Commission (1948-49) gave considerable thought to the question of the selection of vice-chancellors. It rejected the proposal that the selection be taken out of the university's hands on the ground that if the university is responsible for the appointment of the vice-chancellor, he will find it easier to gain the esteem and confidence of the academic community. The Commission observed that 'it is really a part of a university's duty to learn how to choose its own vice-chancellor wisely and that, therefore, to deprive it of this duty would be a counsel of despair'. The Commission recommended that the Chancellor should appoint the vice-chancellor upon the recommendation of the Executive Council which should submit one name only to him. He may, of course, refer the name back if he considers it unsuitable, but should not initiate the appointment himself.

13.34 Taking a long-term view of the matter, we agree with this recommendation and suggest that as the necessary conditions are created, the choice of the vice-chancellor should eventually be left to the university concerned. But in view of the present situation in many of our universities, we recommend, for the time being, the adoption of what is called the 'Delhi pattern'—or some suitable variation of it. According to this pattern, the appointment is made by the Visitor from a panel of three names prepared by a committee consisting of three persons, two of whom are nominated by the Executive Council from amongst persons not connected with the university or any of its colleges, and the third is nominated by the Visitor who also appoints one of them as chairman of the committee. There is no need, however, to prescribe a single pattern for the constitution of this committee. In the University of Rajasthan, for instance, the committee consists of a nominee of the university, a nominee of the Chancellor and a nominee of the Chairman, UGC.

There are, however, two important principles which must be observed. The first is that at least one of the members of the committee should be a representative of the Executive Council of the university. In this regard, we do not favour the existing restriction that the representative of the university should not be connected with it in any way and recommend that it may be annulled, except for paid employees of the university. The second is that all members of the committee should be known for their eminence and integrity to ensure that the selection would not be open to pressures, 'backdoor influences' or other forms

of canvassing which are likely to vitiate it and which can lead to many evils and the growth of cliques in the university. We also suggest that the selection committee should informally consult the university to ascertain its special needs and pay due regard to them. Incidentally, it should obtain the informal consent of the persons to be considered for inclusion in the panel of names for the vice-chancellorship before submitting them to the Chancellor.

13.35 The suggestion has sometimes been put forward that vice-chancellors in the universities should be appointed by rotation from among the deans for a period of two years or so. We do not endorse this suggestion as, apart from other things, it will preclude selection on an all-India basis and lead to a certain undesirable inbreeding. But it may be followed in the appointments of pro-vice-chancellors or rectors where the posts exist. The vice-chancellor should, however, have the authority *not* to recommend the name of a person unsuitable for this purpose.

13.36 The Committee on 'Model Act for Universities' has recommended that the first vice-chancellor of a new university should be appointed by the Visitor/Chancellor or Government. A lacuna in this rule is that if the first vice-chancellor resigns or dies shortly after the appointment, the Visitor/Chancellor cannot make the second appointment even though it is needed in the interests of the university. We, therefore, suggest that the authority to appoint the vice-chancellor during the first five years of a university's life should vest in the Visitor/Chancellor.

13.37 Whatever be the mode of appointment of the vice-chancellor, its main object is to choose the best person available and to grant him suitable conditions of service so that he may function without fear or favour of persons in authority. Generally, the vice-chancellor should be a distinguished educationist or eminent scholar in any of the disciplines or professions, with a high standing in his field and adequate administrative experience. We are not generally in favour of appointment of persons who have retired from other fields. An exception to this general recommendation should be made only in the case of very outstanding persons whose association with the universities would be desirable from every point of view and should not be made an excuse for 'accommodating' or 'rewarding' individuals who do not fulfil the conditions laid down.

13.38 The term of office of the vice-chancellor should be five years and he should not normally be appointed for more than two terms in the same university. The vice-chancellor's appointment is a full-time one; he is the chief executive and academic head of the university and his duties and responsibilities are onerous and demanding. They call for continuous initiative, personal contacts and leadership. We, therefore,

recommend that the old system of appointing honorary vice-chancellors should be discontinued and that all posts of vice-chancellors should be full-time salaried appointments. Also, the conditions of service, and availability of pre-requisites, should not be *qualitatively* different from what apply to professors and other staff of the university. For instance, we are not in favour of providing free house, free electricity and water, and so on. A furnished house—furnished not extravagantly but according to standards appropriate to the academic community—should be provided by the university, but a rent should be charged at the usual rates. We also recommend that the retirement age for vice-chancellors should be fixed at 65 years.¹⁶³ In the case of exceptionally qualified persons of all-India eminence, an exception may be made from the operation of this rule. But such exceptions should be very few indeed and patently justifiable and not be made, we repeat, to 'accommodate' retired officials or politicians or other 'dignitaries'. When the appointment of vice-chancellors becomes a matter of prestige and power politics, the battle may well be taken as lost.

13.39 The universities in our country are passing through a stage of rapid development. In view of this, and also because of the very special position which the vice-chancellor occupies in the life and work of the university, it would be an advantage if his successor can be designated in advance by a year or so. It will mean that the procedure for selecting the vice-chancellor will have to be put into operation sufficiently ahead of the term of expiry of the vice-chancellor in position. This will provide the vice-chancellor-designate an opportunity to get broadly acquainted with the conditions in and the development plans and policies of the university.

13.40 One of the major weaknesses in the existing university Acts is that the vice-chancellor does not have sufficient powers vested in him. In some Acts, powers are delegated to him by the Executive Council; but in others there is no such provision. We agree with the Model Act Committee that adequate powers (e.g., for disciplinary action involving students) should be vested in him for the efficient working of the university. The university Acts should also contain a definite provision for the delegation of powers to the vice-chancellor by the Executive Council.

LEGISLATION FOR UNIVERSITIES

13.41 The nature of university legislation reacts on the efficiency and elasticity of university administration. The Report of the Model Act

¹⁶³ It is of interest to note that the Franks Commission on the University of Oxford has recommended that the term of a vice-chancellor should be four years and that he should be below 61 years of age at the time of appointment.

Committee deals with some of the problems arising out of it and it is neither possible nor necessary for us to go in detail over its proposals. We shall only draw attention to the important authorities of the university, *viz.*, the Court, the Executive Council, and the Academic Council. We have already referred to the Joint Departmental Committees to which we attach great importance. We shall also discuss the establishment of a new authority which is needed, *viz.*, the Academic Planning Board.

13.42 *The Court.* The Court should be the policy-making body of the university with a lay element and should not be concerned with the details of academic matters or the day-to-day administration of the university. It should consist of not more than 100 members, of whom about half should be external. They will include ex-officio members, representatives of alumni, learned professions and industry and nominees of the Executive Council, the Visitor and the Court. As we have recommended earlier, representatives of the students may also be included. It may also be useful to have representatives of the Corporation or Municipality in whose jurisdiction the university is situated. There is no need to give representation to other local bodies; but when the district school boards proposed by us have been constituted, their representatives should be included. Representation should be given to the Parliament in the case of Central universities and to the State legislature in the case of State universities. We would, however, suggest that the Acts of universities should only provide for the total membership of the Court or the Senate while its detailed composition may be provided in the Statutes. This will enable the universities to change the composition of the Court in the light of experience and requirements without going through elaborate legislative procedures.

13.43 *The Executive Council.* The Executive Council, as recommended by the Model Act Committee, should consist of 15-20 members, about half being internal and half external. The vice-chancellor should be its chairman and the pro-vice-chancellor or rector of the university, an ex-officio member. For instance, it may have four deans of faculties who should be full-time teachers, four principals of colleges, three persons elected by the Court from amongst its members, three teachers of the university elected by themselves and four persons nominated by the Visitor and/or Chancellor who may include representatives of the Government.

13.44 *The Academic Council.* The Academic Council should be the sole authority for determining the courses of study and standards. Their

decisions should not need approval by any other authority in the university. According to the Acts of the universities, the Senate or the Court has very little authority for interfering in academic matters. But, the power of the Academic Council to make the necessary regulations is affected in two ways: first, resolutions concerning academic matters are sometimes passed in the Executive Council in the first instance so that they become binding on the Academic Council; secondly, as the Academic Council meets hardly twice a year in most universities, urgent matters are often taken up by the Executive Council. To obviate such difficulties, it will be necessary either to have more frequent meetings or constitute a Standing Committee of the Academic Council to deal with such matters. As we have recommended earlier, student representatives may also be associated with the Academic Council.

13.45 *Academic Planning Boards.* There is need in the universities for a permanent planning and evaluation machinery detached from the day-to-day administration. We recommend the appointment of Academic Planning Boards for this purpose, consisting of the representatives of the university, along with some persons from other universities and a few distinguished and experienced persons in public life. These should be appointed by the Chancellor in consultation with the vice-chancellor. They should be responsible for advising the university on its long-term plans and for generating new ideas and new programmes and for periodic evaluations of the work of the university.

13.46 *Convocations.* We would like to make a comment on the convocation functions in our universities and colleges, as at present organized. The degrees are conferred on students *en masse* and provide little sense of real participation to them and do not, therefore, serve much useful purpose. A reform in its ritual and procedure appears to be necessary. The IUB would do well to appoint a committee to go into the various aspects of this matter including the question of academic dress. The hood and gown are inconvenient and even incongruous in the Indian setting and climate. We note that many countries, e.g., the USSR and Japan, do not require any particular academic dress to be worn by new graduates receiving degrees at a convocation.

13.47 We regret to note that, on two occasions in recent years, university constitutions were suspended by Government. It is our considered view that the suspension of the constitution of a university is an extreme step and should not be taken unless every other instrument of reform has been tried and failed. We do realize that universities are sometimes unable to measure up to expected standards of achievement. The solution to such situations should, however, be found by providing

a built-in device in the university system itself to deal with serious malpractices or maladies. In so far as Central universities are concerned, the President of India, who is the Visitor of the Central universities, has the powers to direct inspection of or inquiry into the affairs of a Central university. With regard to State universities, this authority is vested directly in the State Government. This is not a happy situation and we agree with the Model Act Committee that the Governors of States should be the Visitors of all universities in the State and should have similar powers. We also recommend that a convention should be built up to the effect that before exercising their powers in this regard, the Visitors should consult the UGC.

13.48 *General Recommendations.* Most of the existing university legislation in India needs to be amended in accordance with the broad principles enunciated above. We make the following proposals in this connection:

- (1) The existing legislation for all universities should be reviewed and amended in the light of our recommendations. The Education Ministry and the UGC should take the initiative in this matter. The same principles should also be adopted for all new legislation on the subject.
- (2) A certain amount of variety in the pattern and organization of universities is desirable in the interests of the development and progress of higher education in the country. The recommendations of the Model Act Committee deal with only the most important aspects of the organization of a university and even here alternatives are sometimes suggested, so as to make it possible to preserve the practices and traditions which have been found satisfactory in any existing university. As the Committee stresses it is necessary that the constitution of a university should be formulated in sufficiently general terms so as to leave room for and promote innovation and experimentation.
- (3) It is necessary to evolve a suitable machinery for tripartite consultations between the UGC, the Ministry of Education and the State Governments before legislation relating to universities is enacted. This should take place before bills relating to university education are finalized. Similarly, the Central Government while passing legislation should give an opportunity to the State Governments to express their views. This procedure would avoid many difficulties of the type which have recently arisen and would help the smooth development of higher education in the country.

In this connection, we would like to endorse the following observations of the Model Act Committee: 'Constitutions by themselves cannot

ensure a good organization, and written constitutions need the support of good conventions. While the Committee is offering certain suggestions as guides for improving and modifying the organizational pattern, it is convinced that the proper functioning of a university depends on the all-round acceptance of two basic principles. These are autonomy for universities from external control together with a democratic administrative system, and effective participation of the academic community in the formation and implementation of university policy and programmes.¹⁸⁴

13.49 *Universities and the Law Courts.* Our attention was drawn to the increasing number of law suits filed against the universities and we examined this problem in collaboration with the Indian Law Institute, New Delhi. The study of the information supplied by the universities and the reported decisions of the High Courts and the Supreme Court reveal the following trends:

- (1) The considerable increase in the number of law suits filed against the universities in recent years is mainly due to a change in social attitudes. In the past, one avoided going to a court of law as far as possible, but now the pendulum seems to have swung to the other extreme. A student who is punished for violating the university rules and discipline or is found copying in the examination takes recourse to a law court almost as his first choice; so does a teacher who is sought to be removed from service for working against the interests of the university or for a serious neglect of his duties.
- (2) In a large majority of cases, the decision of the courts has gone in favour of the universities. In the case of one university, we found that out of 64 writs issued, only 4 were decided against it. In spite of this ultimate judgment in their favour, the stay orders and other preliminary proceedings which the courts have inevitably to take in such cases have generally involved expenditure of time and money and proved irksome to the university authorities.
- (3) Except in a few cases, the tendency of the courts has been to leave 'matters connected with education' to be regulated by the educational institutions themselves, unless there is a *prima facie* miscarriage of justice or *mala fide* is proved. Admissions, examinations, discipline of students, and the regulation and maintenance of teaching and non-teaching staff have been regarded as instances of 'matters connected with education'. The Supreme Court has also held that the administration of educational institutions cannot be

¹⁸⁴ Report of the Committee on Model Act for Universities, Ministry of Education, Government of India, New Delhi, 1964, p. 8.

equated with that of an industry and that the principles governing settlement of industrial disputes should not be extended to educational institutions (University of Delhi v. Ram Nath A.I.R. 1963).

13.50 This is a very difficult problem to which there is no easy solution. We would, however, make two main recommendations which **may facilitate matters**:

- (1) The educational system should strive to give a proper value-orientation to education and to create the essential atmosphere necessary to transform all educational institutions into communities of teachers and students. Moreover, steps should be taken to make the administration of educational institutions as democratic as possible by associating the teachers and the students with it so that the grievances of individuals could be satisfactorily settled in most cases within the system itself and the temptation to go to courts of law would be minimized.
- (2) We further suggest that the Government of India may approach the Supreme Court with a request to review the trends seen in the recent decisions of the courts in cases relating to universities and educational institutions and to consider the desirability of framing a suitable policy in this behalf which would help the maintenance of university autonomy and the development of higher education.

13.51 It may be mentioned in this connection that the question whether the decision of a university passing or failing a candidate in an examination is justiciable in a law court was recently considered by the Privy Council in the U.K. The Council has ruled that the courts have no powers to adjudicate in such matters. In another case (Thomson v. University of London) it was decided that regulations and disputes as to the holding of the examinations and the granting of degrees were matters exclusively within the jurisdiction of the Visitor of the University. It would be in the interest of the proper functioning of our universities if similar healthy conventions are clearly established in the country.

AFFILIATED COLLEGES

13.52 *Affiliation.* It is part of the function of the universities to affiliate colleges and confer degrees on their students. Under the practices now in force, each university lays down the conditions for affiliation, sends out teams of inspection and grants affiliation on the basis of their reports.

13.53 In granting affiliation to a college, both the university and the State Government are concerned—the university from the academic

point of view and the State Government, which is required to give grant-in-aid, from the financial point of view. At present, the mutual relationship between the universities and the State Governments in this matter is not clearly defined. In some States, affiliation is granted by the universities without reference to the State Government. In some others, affiliation is a joint affair and is finally granted by the State Government on the recommendation of the university concerned. Moreover, the State Governments which give grant-in-aid to affiliated colleges do not consult the universities in preparing the rules of grant-in-aid or in sanctioning it. It is obvious that these two functions—affiliation and grant-in-aid—are interdependent and that the effective control of colleges is weakened by their separation. We make the following recommendations to improve the present situation:

- (1) Affiliation of colleges in an academic matter should be granted by the universities. But since each affiliation creates eligibility for aid, they should consult the State Government, in respect of all private colleges before a final decision is taken.
- (2) In granting affiliation for the first time, mention should be made not only of the time for which it is granted but also of the courses and the maximum number of students to be admitted to the college. In the admission of science students, etc., the total number to be admitted to each course should be specified. When affiliation is granted subject to certain conditions, there should be a vigilant watch to see that they have been actually and properly fulfilled. Laxity in this behalf has often led to substandard colleges being affiliated, thus depressing standards.
- (3) The State Governments should involve the universities more intimately with the operation of the grant-in-aid system to colleges. It would be desirable to have an informal committee consisting of all the vice-chancellors in the State to advise the Education Department regarding grant-in-aid to affiliated colleges. The committee should be consulted on formulation of grant-in-aid rules or modifications therein and the annual allocations of grant-in-aid. The work of this committee would be of great help both to the Department and to the universities.

13.54 Council of Affiliated Colleges. We recommend that there should be a Council of Affiliated Colleges in every affiliating university, consisting of the representatives of the university and the colleges. It may also be advisable to associate with it, as members, a few representatives of other universities in the State and from outside. The functions of the Council, to be laid down by the Statutes of the University, would be to advise the university on all matters relating to affiliation of colleges, to

help in the implementation of the policy of the university in this matter, to keep a close contact with the colleges with a view to helping in their proper development, and to evaluate periodically whether the standards of colleges are being steadily raised. This is by no means an easy assignment and it can be discharged satisfactorily only if members with a high sense of duty and keen understanding of educational problems are selected.

13.55 It is also necessary to strengthen the existing machinery for the grant of affiliation to colleges and for their periodical inspection. A number of measures can be taken for this purpose.

(1) The conditions for affiliation prescribed by the universities should be reviewed and improved broadly on the lines recommended by the Conference of Principals of Colleges convened by the UGC in May 1964. We would like to emphasize that the primary responsibility for maintaining standards in higher education is on the universities, and unless they show a serious concern for the quality of education very little can be done to improve the situation.

(2) Affiliation should be regarded as a privilege which is to be continuously earned and deserved. It is, therefore, necessary to arrange for periodical inspection of all colleges, preferably once every three years, with a view to ensuring that proper standards are maintained. It has been brought to our notice that this periodical inspection of colleges is not always carried out. One of the main difficulties, especially felt by the universities which have large numbers of affiliated colleges, is that there is no permanent staff for such inspection, that it is very difficult to get together a group of suitable teachers on an honorary basis to constitute the inspection committees and that this difficulty becomes greater when persons from outside the university are to be associated with them, as is obviously desirable. We do not think it would be advisable to entrust the periodical inspection entirely to a whole-time paid staff. It is always necessary to associate eminent university and college teachers with them in an honorary capacity. We are of the opinion, however, that the existence of a small nucleus staff for the purpose will greatly assist in the proper organization of this programme. We recommend that this matter may be examined by the UGC.

13.56 While every effort should be made to strengthen the existing machinery for affiliation of colleges and for their periodical inspection, it would be a mistake to over-simplify the problem and to imagine that this reform by itself would be able to improve their standards. We would like to point out that the reasons which lead to a multiplication of weak colleges are varied and complex and go deep into the socio-economic structure of our society. For instance, such institutions mainly

arise from—

- the rapid expansion of higher education due to various socio-economic factors already discussed in Chapter V (Vol. 1);
- the inability of Government to provide the resources needed to make adequate provision for this expansion;
- the social and political pressures that operate within the university system itself; and
- the political pressures arising outside the university system and which the universities are often unable to resist.

It has to be realized that the basic reform which alone will make it possible to improve standards in affiliated colleges is to relate enrolments to the facilities available. Neither the colleges, nor the universities, not even the UGC, determine solely the policies regarding expansion. These have to be mainly determined by the Central and State Governments in view of the total requirement of trained manpower for national needs and in relation to the plans for the development of agriculture, industry or other sectors of national life. Once these decisions have been taken, it becomes their responsibility to provide the needed resources. What is happening at present is that while expansion is allowed to continue at about 10 per cent per year, the resources provided for this purpose, in real terms, are not even half as much. This cannot but lead to a progressive deterioration in standards and no administrative reform in the machinery of affiliation can cure this basic weakness of educational policy.

13.57 Government Colleges. One of the important responsibilities of the State Education Departments is to manage government colleges. The University Education Commission recommended that Government should not conduct any colleges and that all government colleges should be transferred to the universities. This recommendation has not found general acceptance and even where it was accepted, the results have not always been satisfactory. The most successful instances are probably those of government colleges situated at the headquarters of universities which have been transferred to their management and converted into constituent colleges or departments. A wholesale transfer of all government colleges to the control of the university was made only in one State, Mysore, but the experience was so discouraging that they had to be retransferred to Government. By and large, there is a definite feeling that State Governments should not normally conduct any colleges. At the same time, the transfer of government colleges to universities is opposed by some persons on the ground that it does not help the colleges and burdens the universities with administrative responsibilities that interfere with their development. It is, therefore,

desirable that some suitable agency be devised for the management of such colleges.

13.58 We have examined the point carefully and find that it is not advisable to recommend a single solution which would apply to all cases. There is need to try different approaches to suit local conditions and traditions. We would like to make the following recommendations in this regard.

(1) In States like Madhya Pradesh or Rajasthan, there is a large number of government colleges run by a separate Directorate of Collegiate Education. While this practice may continue, it should be ensured that the Director of Collegiate Education is an educationist of standing. Attempts should be made to eliminate such defects as frequent transfers of staff.

(2) The possibility of setting up an autonomous organization to manage all the government colleges in a State may also be explored. This organization as we envisage it, will have a Governing Board with a whole-time secretary. All the vice-chancellors of the universities in the State should be members of the Governing Board, along with some representatives of Government and some non-official educationists and university teachers. Such an organization is likely to make the administration of colleges less amenable to political influences and considerations, and give it a more academic orientation. It will also incidentally get over the difficulty under which the staff of government colleges (who belong to the State service) cannot be given the scales of pay sanctioned by the UGC.

(3) An alternative possibility is the practice adopted in Delhi where each Government college has been placed under an autonomous Board of Governors. This has the advantage of localizing the staff and enabling it to develop loyalty to their institutions.

13.59 *Private Colleges.* Private colleges form the vast bulk of affiliated colleges and unless they are properly directed and given adequate assistance, the general standards in higher education would not improve. We think that a major change is needed in the present policy which treats all private institutions alike for purposes of control as well as for grant-in-aid. This should be replaced by a discriminating pattern under which the really good institutions are given greater freedom and more liberal assistance while a firm policy of direction is adopted towards weaker institutions which do not deserve larger grants because they fail to make any attempt at self-improvement.

13.60 The procedure for calculation and payment of grants-in-aid should be simplified.

(1) The grant-in-aid for non-recurring expenditure generally presents

no problems. It would, however, be desirable to treat the certified reasonable rent on buildings constructed out of voluntary contributions and without State assistance as approved recurring expenditure for purposes of grant-in-aid. This would encourage raising of funds for capital expenditure.

(2) With regard to the recurring expenditure, it would be desirable to divide the total expenditure incurred into two parts: teacher costs and non-teacher costs. The former, which would include salaries, allowances, and old-age benefits payable to the teaching staff, can be easily determined on the basis of parity with government colleges or in accordance with the rules made by the university. Difficulties arise most frequently with regard to the non-teacher costs. These can be avoided by prescribing a minimum expenditure to be incurred as well as the maximum permissible to a college, preferably as a proportion of the total expenditure on teacher costs. Within these two limits, the college should be left with full freedom to utilize the resources available in the best manner possible.

(3) The fees to be levied in all colleges should be prescribed by the universities in consultation with the State Government. What should be prescribed are 'standard' fee-rates (and also the proportion of free-studentships) and it is only on this basis that the fee-income of the college should be calculated for purposes of grant-in-aid. But the institution should have the freedom to levy higher fees, with the approval of the university, subject to a prescribed upper limit—say, twice the rate of standard fees. The additional income thus received should be at the disposal of the institution to be spent on providing additional facilities for the students and the staff but not used for meeting the contribution which the management is required to make. The college should submit an audited statement of accounts for these funds to satisfy the authorities concerned that there has been no misapplication of funds. This would provide the essential cushion to ensure freedom and elasticity needed for development.

(4) The total grant-in-aid payable should be equal to:

- all teacher costs;
- *plus* non-teacher costs actually incurred or the ceiling prescribed for the purpose, whichever is less;
- *minus* the contribution by the management which will have to be met from its own sources and not from fees; and
- *minus* the income collected at the standard fee rates, after allowing for the prescribed free-studentships.

The contribution by the college management would vary from State to State and area to area. The rate of contribution should also be revised

every five years, the amount to be fixed by the State Governments in consultation with the universities concerned. The standard fee rates as also the ceiling for non-teacher costs should be determined in the same way. We are of the view that, by and large, the management of a college should be expected to provide an endowment of Rs. 500,000 and, until that becomes possible, to make a contribution equivalent to the interest thereon.

COORDINATION AND PROMOTIONAL MACHINERY

13.61 We come now to the agencies charged with overall promotion and coordination in higher education. The two main agencies for the purpose are the Inter-University Board and the University Grants Commission and we shall examine in turn their functioning and what reforms may usefully be proposed.

13.62 *The Inter-University Board.* The IUB was set up by a resolution adopted at the First Conference of the Vice-Chancellors of Universities held in Simla in May 1924. At the time of its inception, India, Ceylon and Burma were its members. According to the available information, 47 Indian universities, 2 universities in Ceylon and 5 Indian institutes of technology are members of the Board at present. Besides these, three institutions 'deemed to be universities' are its associate members.

13.63 The IUB provides a useful forum for exchange of views among vice-chancellors and discussion of common problems. The Board has also helped to enforce some standards and code of conduct among the universities. It is a useful channel through which the Government and the UGC can ascertain the opinion of universities on important problems. It plays the important role of representing university opinion to Government and the public. The United Kingdom Committee of Vice-Chancellors (which corresponds to this Board to some extent) defines this latter function as follows, which is also applicable to the Indian situation: 'Apart from the initiative it takes in making recommendations regarding a common policy on matters of internal concern to the universities, it is the channel through which the University Grants Committee and the Ministries which have contacts with the universities can ascertain the reaction of university opinion to proposals they have in mind or to problems they would like to discuss. Equally, the Vice-Chancellors' Committee may itself approach the UGC or other bodies on matters of concern to the universities generally.'

13.64 In our opinion, the work of the IUB on the above lines would be strengthened and made more effective if its membership is made automatic to include all statutory universities and all institutions deemed

to be universities under the UGC Act. At present, it is open to the Board to admit or not to admit any university to its membership and it is also open to a university to apply or not to apply for membership. Consequently, a number of universities in India are not members of the Board at present, which, in our view, only weakens its position. We, therefore, recommend that all statutory or deemed universities should become members of the Board automatically.

13.65 At present, each university has to give equivalence separately for each degree or diploma given by every other university and one of the functions of the IUB is 'to assist Indian universities in obtaining recognition for their degrees, diplomas and examinations in other universities'. We see no real justification for the Board undertaking this function. It involves considerable delays and hardships, especially when even brilliant students fail to get admission to certain universities for the simple reason that their degree has not been recognized. We recommend that the degrees or diplomas granted by a statutory or deemed university in India should receive automatic recognition from all other statutory or deemed universities. We may also point out that such recognition only confers 'eligibility' and does not in any way interfere with the right of admission. The good offices of the Board should in future be utilized only to secure recognition by foreign universities of the degrees, diplomas and examinations of Indian universities.

13.66 We visualize considerable increase in the functions of the IUB. Even now it acts as a clearing house of information on university affairs and is the central agency for organizing inter-university sports. These responsibilities will continue and should be expanded. It should also be possible for the Board to develop certain advisory, research and service functions for and on behalf of the universities. In order to carry them out, the Board should be strengthened financially and enabled to maintain an adequate secretariat.

13.67 *The University Grants Commission.* On the recommendation of the University Education Commission, the UGC was established under an Act of Parliament in 1956. Its working has been recently reviewed by the Committee of Members of Parliament on Higher Education. In our opinion, it has had a creditable record of work during the first ten years of its existence.

13.68 As at present organized, higher education is divided into a number of sectors and compartments with little communication and interaction between them. The UGC deals with about sixty universities and pays them development grants out of funds placed at its disposal by the Government of India. Besides these, there are agricultural universities drawing their inspiration from the concept of the U.S. land-grant

colleges, which, in the last century, made an important contribution to American professional education and farm productivity. The special feature of the agricultural universities is the stress that is laid on combining agricultural education, extension and research. These universities have also established departments in natural and social sciences to support agricultural education and research. There are also the institutes of technology at Kharagpur, Kanpur, Delhi, Bombay and Madras which, under an Act of Parliament, have the status of 'institutions of national importance' and enjoy the power to confer degrees. Assistance from the Central funds to agricultural universities, as also to the IITs, is not channelled through the UGC but provided by the Ministry of Agriculture and the Ministry of Education respectively. Central assistance for medical education is given by the Ministry of Health. It may also be mentioned that teacher education is the responsibility of the universities only in a limited measure. This fragmentation unaccompanied by any effort at effective coordination is a serious weakness in our present pattern of higher education.

13.69 In our opinion, the UGC should represent the entire spectrum of higher education. It should be professionally concerned and adequately equipped to deal with all its problems. This is necessary for various reasons but principally because, in the contemporary world, no discipline can develop fully in isolation from the main stream of academic life. Agriculture, technology, medical sciences and teaching will all be the richer for being part of this broad stream and by being concerned with the problems and needs of one another. This applies most directly to teaching, but will apply more and more to research also. The real breakthroughs in the future will most likely be made at the frontiers where different disciplines meet. It may also be incidentally pointed out that this position is in consonance with the existing Act of the UGC which is designed to embrace all branches of higher education. We, therefore, fully support the recommendation of the Committee of the Members of the Parliament on Higher Education that all higher education should be regarded as an integrated whole, that professional education cannot be completely divorced from general education, and that it is essential to bring all higher education, including agriculture, engineering and medicine, within the purview of the UGC. This is the ultimate direction in which we should move.¹⁶⁵

13.70 We have examined this problem in all its aspects and have come to the conclusion that although it is a desirable long-term goal, it will not be possible to take this step immediately and that, for the time being, it would be more feasible to set up separate UGC-type organizations for agricultural, engineering and medical education and to create

¹⁶⁵ This was also the view of the University Education Commission.

a machinery that would effectively coordinate them. Our proposals for immediate action, therefore, are as follows:

- (1) It is not desirable that Government should deal direct with the universities. It is always a great advantage to interpose, between the Government and the universities, a committee of persons selected for their knowledge and standing rather than for their political affiliation or official status. Such a device ensures the necessary coordination between Government and the universities, allocates Government grants to institutions of higher education on the basis of their carefully assessed needs and yet insulates them from inappropriate political influences. As the Report of the Committee on Higher Education in the UK has pointed out, 'The Government is thus advised by a body which though appointed by Government, is independent of ministerial and departmental control and is composed chiefly of persons with intimate knowledge of university life and its conventions. This immunity from direct ministerial intervention is further strengthened by immunity from the normal application of public accountability. . . . Thus individual universities are very largely insulated from direct intervention by the Government or Parliament in the detailed ordering of their affairs.'¹⁶⁶
- (2) UGC-type organizations, based on the above principle, should be set up for dealing with technical, agricultural and medical education. They need not necessarily be set up by law and our purpose will be served if they are established as autonomous organizations. They should be composed of teachers and scientists of eminence in their fields and should be small and compact bodies so that they can meet frequently and work expeditiously. The head of such an organization should himself be a scholar or scientist of repute in the field. They should function more or less like the UGC, i.e., lump-sum grants should be placed at their disposal by the Ministries concerned and they should have the freedom to distribute them to the universities in relation to their needs and programmes of development.
- (3) For purposes of coordination, there should be a certain overlapping membership between the UGC and the UGC-type organizations recommended above. In addition, the chairmen of all these four bodies should meet periodically to review and coordinate their programmes.

13.71 The Committee of Members of Parliament on Higher Education had expressed the view that it would be undesirable to appoint

¹⁶⁶ *Report of the Committee on Higher Education, U.K.*, H.M.S.O., London, 1963, paragraphs 728-729.

a person who is holding a full-time appointment as vice-chancellor as a member of the UGC. This proposal has been accepted by Government and the necessary changes are being made in the UGC Act. We are unable to agree with this view and are of the opinion that the UGC should not be deprived of the services of an eminent person merely on the ground that he happens to be a vice-chancellor. In our view, the UGC should consist of 12—15 members. Of these, not more than one-third should be officials of Government. At least one-third should be from the universities and we would not rule out a vice-chancellor being included. The remaining should be eminent educationists. In order to provide a greater degree of rotation, we recommend that the term of office of members may be reduced from the present six to three years with not more than one extension.

13.72 It will be advisable for the UGC to adopt a practice of working through a number of standing committees set up to deal with important responsibilities entrusted to it. For example, there may be standing committees on affiliated colleges, teacher education, including the training and orientation of university teachers, preparation of university textbooks and development of literature in modern Indian languages, and student welfare, including scholarships. Each standing committee should consist of some members of the UGC and a number of experts in the field coopted for the purpose.

13.73 It is sometimes stated that the UGC has so far not carried out any formal inspection of a department of any university under section 13(1) of the UGC Act, nor has it exercised the power under section 14 for withholding the grants. We do not think this to be entirely a fair criticism. The UGC arranges a visit of the universities every five years through visiting committees and grants-in-aid are sanctioned on the basis of their recommendations. We fully support this procedure and recommend that it may even be desirable to arrange these visits more frequently, say, every three years. Moreover, these should be done in greater detail and depth than is generally the case at present. The visiting committees should meet, not only the officers of the universities concerned and heads of departments, but also the other members of staff and the students. It would also be a good thing if written memoranda are invited from persons concerned at the time of each visit. Similarly, we do not think that the vigilance of the UGC in financial matters is to be judged by the extent to which it has withheld grants—this is an extreme power which is not to be lightly exercised and the effects of which are likely to be adverse to the larger interests of education. In our opinion, a better basis for judgment is provided by the projects for which grants-in-aid have been sanctioned and which have been implemented so far. On this ground, we have hardly

heard any criticism and have had considerable evidence to the contrary.

13.74 It has to be borne in mind that the relationship between the universities and the UGC is a very delicate one, and that the UGC can become an effective instrument for upgrading of standards only if it follows the method of persuasion rather than coercion. In a situation of this type, there will always be some people who think that the UGC is over-exercising its authority while others will be inclined to believe that it is using it inadequately. Incidentally, we may point out that similar criticism has also been levelled against the University Grants Committee in the UK and the following quotation from its Report for 1957—62 will be found interesting:

The major question must be whether the measure of control which the State has entrusted to the Committee is exercised too heavily or too lightly. Some people—not all in the universities—feel that the Committee's influence has been too great or is becoming too great; others—not all outside the universities—feel it is too light. This balance of opinion is perhaps a measure of their success.¹⁶⁷

13.75 In view of the magnitude and importance of the problems facing the Commission, considerably larger funds will have to be made available to enable it to deal effectively with them. An appraisal of development schemes undertaken by the Commission and those suggested by us indicates that the available allocation under the Fourth Plan would not be commensurate with the basic developmental needs of universities and colleges. We discuss this issue more fully elsewhere.¹⁶⁸

13.76 The Model Act Committee raised the question of University Grants Commissions or Committees being set up by the State Governments for universities within a State, but made no specific recommendation. The Standing Committee of the IUB was strongly against the establishment of such Committees in the State, holding that if the State Government required any advice, it should consult the UGC. We agree with this view. In giving grants to universities, the questions of finance and standards, and collaboration between universities outside a given State, are all intimately linked. It may lead to confusion if the responsibility for coordinating standards was distributed amongst a number of bodies such as the Central UGC and the State UGCs. It would also hinder the existing direct relationship between the UGC and the universities.

¹⁶⁷ *University Development (1957-62)*, H.M.S.O. London, p. 198.

¹⁶⁸ Vol. IV, Chapter XIX.

SUPPLEMENTARY NOTE

THE INTER-UNIVERSITY BOARD ON UNIVERSITY AUTONOMY

13S.01 The Inter-University Board considered the question of university autonomy and some of the recent university legislation which went contrary to it and passed the following resolution at its 41st annual meeting held at Mysore in February 1966:

13S.02 The Inter-University Board notes with grave concern and anxiety some of the recent amendments to university Acts in different States and the consequent deprivation of the academic freedom and responsibility of the universities.

13S.03 In particular the Board is gravely concerned over those recent amendments whereby the vice-chancellor of the university is subjected to conditions of service which the academic world regards as humiliating and the university itself is sought to be controlled by directions likely to be issued on political and academically invalid considerations. In the opinion of the Inter-University Board, this is wholly inconsistent with the spirit of the universities and is likely to lead to the universities becoming incapable of discharging their functions efficiently.

13S.04 The Inter-University Board is firmly of opinion that the mere fact that certain contributions are made by a State Government or even by the Centre cannot be a justification to bring about changes which will radically alter the composition, the working and efficiency of the universities and humiliate the universities concerned in the eyes of the academic world. The Board is of the opinion that a statutorily established university is practically in the same position as a statutorily established political government and the mere fact that the legislatures of such governments have certain powers of legislation should not be utilized to lower the reputation of Indian universities and to make their efficient working impossible.

13S.05 The Board, therefore, resolves, before taking any further steps in the matter, to appoint a committee to review the provisions in the different university Acts and the innovations that have been made which are detrimental to academic efficiency and the honour and dignity of universities and to suggest ways and means by which things can be improved so as to establish cordial relations with the Government of the day consistent with the position of the universities. The Board is of opinion that unless the vice-chancellor of a university is

able to command the confidence of his colleagues and the respect of the students and unless there is sympathy and good relationship with the Government, no university can function well.

The members of the Committee which consisted of Dr. C. P. Ramaswami Aiyar, Dr. A. L. Mudaliar, Dr. C. D. Deshmukh, Dr. K. L. Shrinani and Dr. B. Mullick examined the whole problem and issued the following statement:

8.06 By virtue of the generally accepted view regarding their intellectual leadership of the community, the universities are the key to social and economic progress. Therefore it is important that the universities should be helped to grow and develop their personalities unhindered by extraneous pressures. The fullest possible measure of autonomy is indispensable for their proper functioning and growth in the interests of the country's advancement and it is essential to draw attention to and oppose effectively any tendencies contrary to this objective. Keeping these considerations in mind the Committee recommends as follows:

- (1) The President of India, as in the case of the Rajasthan University, should be the Visitor of every university in the country.
- (2) The practice of having State Governors as chancellors of universities in their States has much in its favour, but only if the chancellors function in their individual capacity, consulting the State Government only when they consider it necessary.
- (3) Legislatures may and indeed should discuss matters of educational policy, but in order not to hamper the universities in their day-to-day functioning, they should refrain from discussing matters which fall essentially and peculiarly within the domestic jurisdiction of the universities.
- (4) No Minister should hold any office in a university *ex officio*.
- (5) Provisions in certain recent university Acts for issuing directives or giving instructions to universities are particularly obnoxious and must be deleted. Such provisions would inevitably lead to violations of the autonomy of universities. There is no reason to believe that the authority which issues instructions to universities is more competent to decide essentially academic issues than the university itself which is functionally best constituted to deal with these problems.
- (6) Conditions of service for vice-chancellors should not be made humiliating or unattractive in any manner so that suitable people may not feel deterred from accepting the post of vice-chancellorship.
- (7) As in various countries, notably in England, a convention should be evolved whereby the judiciary *suo moto* treats universities as

a sector of public life which should be allowed to regulate its own affairs.

- (8) In order to ensure autonomy for universities it is important that the Finance Commission while allocating resources to States every five years should state as precisely as possible those considerations which have led it to allocate resources in a certain manner. At present while the Finance Commission allows increased resources to States at the time of its recommendations, the amount required for universities is not always allotted to them with the result that universities, in the absence of adequate resources, do not function effectively.
 - (9) Over the last few years university Acts have been amended frequently and not always on the basis of academic considerations or other adequate reasons. However, some of them need to be amended now in the light of recommendations made by the Model Act Committee Report as finally approved by the Inter-University Board and the University Grants Commission.
- 13S.07 To sum up, the Inter-University Board seeks support in two directions from everyone in a position to help:
- (a) To secure deletion of some of the provisions mentioned above, which seem to them to detract from university autonomy, e.g.,
 - (i) provision for the removal of vice-chancellor after an inquiry by an outside authority;
 - (ii) the issue of directives by an outside authority to the university;
 - (iii) nomination of Ministers as pro-chancellors—*ex officio*;
 - (iv) appointment of pro-vice-chancellors without consulting the vice-chancellor.
 - (b) To have the existing university Acts amended in terms of the recommendations made by the Model Act Committee as finally approved by the Inter-University Board and the University Grants Commission.

SUMMARY

1 Universities should evolve dynamic techniques of management and organization suited to their special functions and purposes. The UGC should encourage the formation of groups in universities to study the problem of educational administration and management of university affairs. 13.02

2 *University Autonomy.* The proper sphere of university autonomy lies in the selection of students, the appointment and promotion of teachers and the determination of courses of study, methods of teaching and the selection of areas and problems of research. 13.05

3 *Autonomy within a University.* (1) The representation of the non-academic element on university bodies should be mainly for the purpose of presenting the wider interests of society as a whole to the university but not to impose them.

(2) The universities should give considerable autonomy to their departments. The principle that good ideas often originate at the lower levels must be recognized and respected in the governance of a university. Wider administrative and financial powers should be delegated to a Committee of Management to be set up in each department under the chairmanship of the head of the department.

(3) The freedom and autonomy of colleges must be recognized and respected in the same spirit as the university wants it for itself.

(4) There should be joint committees of teachers and students in each department and in every college, and a central committee under the chairmanship of the head of the institution for the discussion of common problems and difficulties. Student representatives should also be associated with the Academic Councils and the Courts of Universities. 13.09

4 In India, the tradition of university autonomy is fairly strong and will have to be consolidated in time. This imposes special responsibilities on Government, UGC, IUB, the public and the universities themselves. In particular, the following need emphasis:

(1) A suitable machinery for consultations between universities, the UGC, IUB and the Government should be developed for reaching decisions regarding number of students to be trained, courses of study and problems of applied research.

(2) The UGC, the IUB and the intelligentsia have an important

role to play in creating a strong public opinion in favour of university autonomy.

- (3) The universities have to continually earn and deserve their autonomy by discharging their intellectual and public obligations effectively. 13.10-15

5 *University Finances.* (1) The State Governments should place adequate financial resources at the disposal of universities and simplify rules and procedures for operating them.

(2) The UGC should be enabled to give both development and maintenance grants to State universities.

(3) There should be some reasonable sharing of developmental expenditure on universities between the UGC and State Governments.

(4) UGC should take steps to resolve problems faced by some universities on account of the non-payment of grants on committed expenditure by State Governments.

(5) The system of grant-in-aid from the State Governments to the universities should be reorganized on the basis of a suitable system of block grants.

(6) The finance of universities should be placed on a sound footing on the basis of advice given by the UGC to the State Governments and the universities after periodical review.

(7) Universities should be immune from *direct* governmental intervention and also from *direct* public accountability. 13.16-31

6 *Role and Appointment of the Vice-chancellors.* (1) While the choice of the vice-chancellor should eventually be left to the university concerned, for the time being, the present 'Delhi' pattern, or some variation of it may be adopted. The members of the Selection Committee for the vice-chancellor should be known for their eminence and integrity and there should be no objection to one of them being connected with the university but he should not be a paid employee of the university.

(2) The authority to appoint the vice-chancellor during the first years of a university's life should vest in the Visitor/Chancellor.

(3) The vice-chancellor should, as a rule, be a distinguished educationist or eminent scholar with adequate administrative experience.

(4) The term of office of the vice-chancellor should be five years and he should not be appointed for more than two terms in the same university.

(5) All posts of vice-chancellors should be whole-time and carry a salary.

(6) The retirement age for the vice-chancellor should be 65 years, an exception being made in the case of exceptionally qualified persons of all-India eminence.

(7) It would be an advantage if the successor to a vice-chancellor could be designated, so far as possible, in advance by a year or so.

(8) Adequate powers should be vested in the vice-chancellor for the efficient working of the university. 13.32-40

7 Legislation for Universities. (1) The Court should be the policy-making body of the university with a membership of not more than 100, of which about half should be external.

(2) The Executive Council with the vice-chancellor as chairman should consist of 15—20 members, about half being internal and half external.

(3) The Academic Council should be the sole authority for determining the courses of study and standards.

(4) A standing committee of the Academic Council should deal with urgent matters, if the Academic Council cannot meet frequently enough for the purpose.

(5) Each university should have an Academic Planning Board for permanent planning and evaluation, detached from day-to-day administration.

(6) The IUB should appoint a committee to go into the question of reform of ritual and procedure of convocation functions.

(7) The Governors of the State should be the Visitors of all universities in the State and should have power to direct inspection or inquiry into the affairs of a university.

(8) The Ministry of Education and the UGC should take the initiative to revise existing university legislation in India and to amend it in the light of the recommendations made.

(9) The constitution of a university should be formulated in sufficiently general terms so as to leave room for, and promote, innovation and experimentation.

(10) A suitable machinery for tripartite consultations between the UGC, the Ministry of Education and the State Governments should be evolved before legislation relating to universities is enacted. 13.41-48

8 Universities and the Law Courts. The Government of India may request the Supreme Court to frame a suitable policy to help the maintenance of university autonomy and the proper development of higher education. 13.49-51

9 *Affiliated Colleges.* (1) Affiliation of colleges should be granted by the universities after consultations with the State Government have been made.

(2) A committee of vice-chancellors in the State should be set up to advise the Education Department regarding the grant-in-aid to affiliated colleges.

(3) There should be a Council of Affiliated Colleges in every affiliating university to advise the university on all matters relating to affiliation of colleges.

(4) The existing machinery for the grant of affiliation to colleges and for their periodical inspection should be strengthened.

(5) Affiliation should be regarded as a privilege which is to be continually earned and deserved.

(6) The UGC may examine the question of a small nucleus staff being sanctioned to each affiliating university for the proper organization of an inspection programme.

(7) The most important reform which alone will make it possible to improve affiliated colleges is to relate enrolments to the facilities available.

13.52-60

10 *Government Colleges.* (1) Different approaches to suit local conditions and traditions may be devised for the management of Government colleges, e.g., the establishment of a separate Directorate of Collegiate Education, or an autonomous organization for all Government colleges in a State, or placing each college under an autonomous Board of Governors.

13.57-58

11 *Private Colleges.* (1) A discriminating policy should be adopted so that greater freedom and assistance to the really good private institutions could be given.

(2) The procedure for calculation and payment of grants-in-aid should be simplified on the lines recommended.

13.59-60

12 *The Inter-University Board.* (1) All statutory or deemed universities should become members of the IUB automatically.

(2) The degrees or diplomas granted by a statutory or deemed university in India should receive automatic recognition from all the other statutory or deemed universities.

(3) The IUB should be strengthened financially to enable it to develop advisory, research and service functions for and on behalf of the universities.

13.62-66

13 *The University Grants Commission.* (1) All higher education should be regarded as an integrated whole and the UGC should eventually represent the entire spectrum of higher education. For the time being, however, it would be more feasible to set up separate UGC-type organizations for agricultural, engineering and medical education and to create a machinery that would effectively coordinate them.

(2) The UGC should consist of 12—15 members, not more than one-third should be officials of government and at least one-third from the universities. There should be no objection to a serving vice-chancellor being appointed as a member of the UGC.

(3) The UGC should adopt a practice of working through standing committees set up to deal with important responsibilities entrusted to it.

(4) The visiting committees appointed by the UGC should visit each university every three years and work in greater detail and depth.

(5) Considerably larger funds should be available to the UGC to enable it to deal effectively with the magnitude and importance of the problems and responsibilities as envisaged.

(6) The responsibility of coordinating standards should continue to vest in one body, viz., the UGC. State UGCs should not, therefore, be created.

13.67-76

CHAPTER XIV

EDUCATION FOR AGRICULTURE

14.01 Recent events have dramatized the backward state of agricultural development in India. It is well known that food production has not kept pace with population growth, nor increased at a rate which can ensure at least a minimum balanced diet for all Indians. We are at the moment dependent on the surplus production of other countries to avoid famine. This is critical enough in itself but it is further compounded by the fact that an under-developed agriculture retards industrialization by its demands on foreign exchange, by its lack of surpluses for industrial exploitation and by the maintenance of a low purchasing power among the masses of the people. Difficult as this situation now is, it is likely to become even more critical in about ten years' time when the total population will exceed 600 million and when, on present world trends, it seems unlikely that surplus food will be available from other countries to offset our own shortages.

14.02 The tasks before agricultural development are, therefore, clear. We must attempt at least to double the production of food in the next fifteen years and maintain an adequate rate of growth thereafter. We must change food habits, lessen our dependence on the vagaries of the monsoon and the winter rains, diversify and improve the quality of the products of our farms, forests and fisheries and push through a rural improvement programme to transform the life in the villages from one of feudal backwardness into that of modernized communities.

14.03 These goals can only be achieved through the application of science and technology to the problems of agricultural production and rural betterment. This involves large-scale capital investment for the provision of irrigation, fertilizers, pesticides, improved seeds, credit facilities for farmers, satisfactory arrangements for storage and distribution of farm products, improved communications and transport, electrification, etc. But this is not enough. We must in addition provide for high quality education and research for agriculture. Without them, the necessary rapid increase in agricultural production will not be possible and there may even be a danger of the capital inputs being wasted. An instance is the present wasteful use of irrigation waters which, applied more intensively to the smaller areas and with greater attention to drainage, could significantly increase agricultural produc-

tion. Indeed in some areas, knowledge can be partially substituted for capital investment.

14.04 This programme of education for agriculture will be based on three main elements—*research* or the development of the appropriate technology, *extension* or the communication of the technology to practising farmers, and *training* of the needed personnel.

(1) *Research*. The most significant of these is the development of a new agricultural technology based on science. During the past hundred years, agriculture in many parts of the world has been revolutionized, in part by the development of chemical engineering and mechanization, and in part by a more fundamental revolution in man's biological understanding. This new scientific understanding of the nature of living creatures, both plants and animals, has led to a spectacular improvement in agricultural technology in the advanced countries. Much of the existing technology of chemical fertilizers and of soil and water development can be directly applied to Indian conditions. But these and the new biological technology must be modified to suit the local conditions; and for this purpose applied research is necessary in a number of fields including plants and animal nutrition, genetics, physiology, pathology, the various fields of microbiology and many others.

(2) *Extension*. The development of this new technology will, however, only be justified if the knowledge is conveyed to the farmers and they are motivated and trained to adopt it and increase their yields and family incomes. Apart from programmes of improving the educational level of the average farmer, this implies the organization of a large-scale programme of extension services.

(3) *Training of Personnel*. The development of the new technology, the organization of extension services to the farmer and the development of the large complex of agro-industries which the country needs will not be possible unless we train thousands of highly educated agricultural scientists and engineers and an even larger number of technicians and extension workers.

This organic link between the three elements of teaching, research and extension is necessary to ensure that there is a two-way flow from the farmer to the research worker and the classroom and from the research laboratories and teaching departments back to the farmer.

14.05 But if agricultural development is to receive the impetus it needs, education for agriculture must become a major concern of the entire national system of education whose responsibilities go beyond the training of specialized personnel. An orientation towards agriculture must be given in all educational institutions. Furthermore, the education

system must give the training needed to those who will man the supporting services required for agricultural development. It must also develop an understanding of agricultural problems and rural life among the large group who deal indirectly with these, such as planners, administrators, lawyers, bankers, community leaders and *entrepreneurs*. It is on these groups that the better development of essential supporting services such as credit, crop insurance, marketing, pricing, distribution and the provision of better conditions and incentives for farmers will depend.

14.06 In order to develop programmes which meet the above needs quickly and effectively, it will be essential, among other things,

- to set up a number of agricultural universities with integrated programmes of research, training and extension;
- to attract talented students, researchers and teachers to agriculture;
- to develop programmes of agricultural research, training and extension in other universities and institutions of higher education;
- to improve agricultural colleges;
- to establish agricultural polytechnics to train agricultural technicians;
- to give a certain orientation to agriculture and rural problems in the educational system as a whole;
- to develop agricultural extension programmes, and particularly to establish primary extension centres; and
- to associate successful and progressive farmers closely with the agricultural universities, colleges, polytechnics and primary extension centres and to give them adequate status and facilities.

These are the programmes which we propose to discuss in some detail in this chapter.

AGRICULTURAL UNIVERSITIES

14.07 *Main Features.* The central point in the programme we are recommending is the establishment of at least one agricultural university in each State. The programme is not new. In fact, beginning from the University Education Commission, there have been a series of recommendations pointing to the need for rural or agricultural universities which will have strong polarization around the agricultural sciences and which will combine the work of teaching, research and extension. As a result of these recommendations, a number of agricultural universities have already been set up. But their growth has not been very even; and no adequate attempt has been made to establish a liaison between them and the other universities. There has also been some misunderstanding of the objectives of these institutions. We shall

therefore describe what, in our view, should be their basic characteristics and the manner in which they should function.

14.08 The training of agricultural graduates has been traditionally the responsibility of universities, while research and extension activities have been the province of Central and State Departments of Agriculture and the Community Development Administration programmes. These have developed for the most part independently and with little liaison between them, in spite of the fact that some of the agricultural colleges have been under the administrative control of the State Governments. Such isolation has seriously affected the quality of training given and the research carried out, both of which have been insufficiently related to farm practice. The most distinctive features of the agricultural universities is their integrated programme of research, training and extension. It is this that will make the break-through in education for agriculture.

14.09 In addition, these universities should have the following features:

- (1) Their concern with all aspects of increasing, disseminating, and applying knowledge related to agriculture, including basic and applied research;
- (2) Their primary emphasis on teaching and research directly and immediately related to the solution of the social and economic problems of the countryside;
- (3) Their readiness to develop and teach the wide range of applied sciences and technologies needed to build up the rural economy;
- (4) Their readiness, not only to teach undergraduates, postgraduates and research students, but also to give specialized technical training to young people who are not candidates for degrees; and
- (5) Their emphasis on adult and continuing education side by side with teaching regularly enrolled students.

14.10 *Scope.* Keeping in mind these characteristics, it is clear that the agricultural universities will be able to carry out their tasks only if their teaching and research range over many academic and professional fields. They should begin with and for some time concentrate on the traditional agricultural specialties such as agronomy, plant genetics, animal breeding, animal husbandry, veterinary science, plant pathology, soil science, microbiology, horticulture, entomology and parasitology. But in time they should develop the full range of courses indicated below:

- (1) *Engineering for Agriculture.* Irrigation engineering; ground-water hydrology; civil engineering for design, construction, operation, and maintenance of surface water supply systems; crop

processing; mechanical engineering concerned with farm machinery and equipment, including well pumps, motors and strainers. One of the most striking failures of our engineering education has been the lack of appreciation by the engineers in charge of water resource development, of plant and soil requirements for irrigation, water supplies and drainage. A new kind of engineer is needed and in his training the agricultural universities, IITs and other universities all have a role to play.

- (2) *Specialists in Human Nutrition and Food Technology.* Even with present inadequate food supplies, the diet of the poor could be considerably improved, if inexpensive high quality protein supplements could be prepared, distributed, and made acceptable to the people; if food wastage could be lowered by better methods of preservation; and if knowledge of nutritional needs and methods of meeting them could be widely disseminated among the rural people.
- (3) *Agricultural Economics.* Market research, agricultural data collection and analysis, production economics, farm management, rural credit, crop insurance benefit, cost analysis, and other techniques of project evaluation and price structures for farm products.
- (4) *Public Administration.* Organization of government agricultural services, management of cooperatives, local self-government and relations between different governmental levels.
- (5) *Mass Communications.* Adult education, audio-visual teaching and preparation of instructional materials.
- (6) *Sociology, Anthropology and Law.* Analysis of village traditions, social structures and values and their constructive modification; land tenure and tenancy systems; and development of principles of land reform and consolidation.
- (7) *Resources Conservation.* Soil and water conservation, erosion control, range management, reclamation, and soil classification and surveys. A significant proportion of India's 323 million acres of crop land and 177 million acres of forest land has deteriorated through misuse, and urgently needs remedial treatment. An overall land management strategy will depend on a national land survey and inventory, using criteria which can be expressed in terms of crop yield enhancement, costs and time periods.
- (8) *Forestry.* Forest management and technology of forest products such as fuel, timber, paper and cellulose.
- (9) *Fisheries.* Agricultural pond fisheries; river and lake fisheries; marine fisheries; design, construction, maintenance, and operation of fishing vessels and fishing equipment; fish processing and preservation; and fisheries economics.

- (10) *Earth Sciences.* It is of the utmost importance for Indian agriculture to be able to forecast the time of the onset of the monsoon, its intensity and continuity, particularly in the first six weeks of the rainy season. These forecasts should not be on a day-to-day basis but should be made for periods of several weeks or preferably several months. In order to make such forecasts, both more meteorological data from the Indian Ocean and better understanding of the atmospherics that cause the monsoon are needed. The number of Indian meteorologists educated in modern meteorological theory, observational techniques, and forecasting methods is inadequate. There is an equal scarcity of oceanographers capable of making or interpreting oceanographic measurements. To remedy this situation, Departments of Earth Sciences should be built up as rapidly as possible in several agricultural universities. Besides emphasizing meteorology and oceanography, these departments should also concentrate on ground water geology (the technology of finding and appraising ground water resources) and on engineering geology (appraisal of dam sites and the location of materials for heavy construction).
- (11) *Basic Sciences.* For all the applied sciences and engineering specialities listed above, the students will need a firm foundation of basic science. The agricultural universities should develop departments in statistics, applied mathematics, operational analysis, physical chemistry, biochemistry, molecular biology and physiology.
- (12) *Humanities.* Similarly, the students in the social sciences will need a background of Indian history and literature to gain an understanding of the traditions and values of rural society. The faculties of the agricultural universities should, therefore, contain some scholars in humanities, even though the faculty balance should remain strongly tilted towards practical and professional subjects.

14.11 *Functions.* The functions of the agricultural universities will be

- research and teaching at postgraduate level, including research aimed at improving agricultural production, processing and marketing;
- teaching at the undergraduate level; and
- extension.

In research and extension, a clear delineation of responsibility between agricultural universities and the State Departments of Agriculture will need to be drawn. The universities should manage all State

research stations and as far as possible, demonstration farms, but they should cooperate fully with the Departments in their extension work and coordinate this with the programme activities of the Departments.

14.12 *Postgraduate Education and Research.* The importance of the postgraduate work in providing the leadership needed in agriculture, and in bringing about quantitative and qualitative improvement in the teaching of agriculture is now widely recognized. Postgraduate education in agriculture and animal sciences has, however, not been developed on a scale commensurate with needs, either from the quantitative or from the qualitative points of view, and several important areas have been almost completely neglected.

14.13 Postgraduate work should become a distinctive feature of the agricultural universities. Their postgraduate departments will have to provide the agricultural sector with research workers, subject matter specialists and teachers for the secondary schools and agricultural polytechnics. Many of the administrative officers and certainly all the subject matter specialists in the extension service should hold M.Sc. or Ph.D. degrees. Likewise, senior scientists in all research institutes and teachers in agricultural universities and agricultural colleges should have postgraduate training.

14.14 Estimates of the requirements of specialist personnel at this level during the next twenty years have not been worked out with the precision that is necessary and possible. The ISI/LSE Paper which has been reproduced in a later section gives some basis for these; but these need further investigation, closer analysis and revision. Depending as they do on the progress in reorganization of research and extension services, the development of educational institutions and of agro-industries, the forecasts will not be useful unless they are continually revised. Broadly, however, we estimate that one hundred thousand people (agricultural research—10,000; education—35,000; agricultural and agro-industries development—55,000) with postgraduate training will be needed in the next two decades in addition to those already in position. This would mean adding 5,000 postgraduates per year during the next twenty years.

14.15 The present yearly intake into postgraduate courses is about 13,000 in various fields of agriculture, about 200 in animal sciences and negligible numbers in other fields like agricultural engineering, agricultural economics, animal breeding, and other specialized fields. To meet the anticipated output of 5,000 postgraduates per year, the present intake would have to be increased in proportion, a higher acceleration being desirable in the hitherto neglected areas.

14.16 Even more important, however, is the need to raise the

quality of the product. Many of the existing institutions lack the physical facilities, adequately trained staff and in particular the atmosphere so essential for quality education. It is very important that a possible lowering of standards consequent on the numerical increase projected above should be scrupulously avoided by adequate advance preparation. For this purpose, urgent steps should be taken to strengthen the provision of staff and other facilities in existing institutions and to carry out the adjustments and changes that expansion necessitates. Indeed, from this point of view, it may be preferable to suffer a shortage during the immediate years than to produce poorly trained personnel just to meet current demands on an *ad hoc* basis. We would, therefore, recommend that expansion of personnel and facilities should be undertaken only in a few selected, quality institutions and not be based on any other considerations.

14.17 How can quality training be ensured : Postgraduate education should not be looked upon as a mere extension of undergraduate education as appears to be the common situation in the country today. At the postgraduate level, there must be an effective integration of various disciplines and a symbiotic mingling of active research and teaching. We therefore recommend that no institution should be allowed to undertake postgraduate instruction unless it has a strong and broad-based programme of basic and applied research of its own and the members of the faculty are participating actively in the research programme. Such an active research programme is essential if teachers are to keep in touch with recent advances in general and in their own specialized fields in particular. It is also necessary if the students are to be given sufficient training in research methodology, which should be an integral part of all postgraduate training. Good libraries, well-equipped laboratories and adequate experimentation facilities are also of great importance, and no postgraduate institution can function without them.

14.18 We also urge that before any institution is allowed to develop postgraduate instruction, a competent body of professional persons should examine the stature of the institution and the physical facilities available. Only such institutions as have adequate facilities for education and research should be authorized to go ahead with programmes of postgraduate instruction.

14.19 Some of the central research institutes, like the Indian Agricultural Research Institute (IARI), the India Veterinary Research Institute (IVRI), and the National Dairy Research Institute (NDRI), and the agricultural universities would constitute suitable centres for strong postgraduate schools in agriculture. The IARI has already gained a position of pre-eminence in this field and the IVRI and NDRI are also research

and teaching institutions of national importance which are being developed still further. In addition, each agricultural university should develop postgraduate work, perhaps concentrating on certain specialities suited to their history, location and interests. Close cooperation and interdependence should be forged between the different agricultural universities themselves and also between them and the central research institutes which are seats of active postgraduate instruction. Free movement of staff and students from one institution to another would be highly desirable.

14.20 We understand that the premier body concerned with agricultural research, the ICAR, is itself being reorganized in such a way as to bring about close integration of education, research and extension. A process of rationalization of the research set-up in the country is envisaged with the strengthening of selected central and regional research stations and the abolition of many of the existing, poorly equipped and poorly staffed small stations. All the central agricultural research institutes are being brought together under the ICAR which will coordinate and support problem-oriented and production-oriented research programmes at these institutions as well as in the country as a whole. Close cooperation between such central research organizations and the agricultural universities would obviously be desirable. The ICAR which is to be closely connected with agricultural education, especially in the agricultural universities, can play a very important and leading role in bringing about such integration. The ICAR has in recent years developed some very worthwhile and fruitful projects of coordinated research on an all-India basis with active Centre-State cooperation which are proving to be highly effective not only in making research activity more efficient, expeditious and productive, but also in the development of valuable research potential in the country and, what is even more important, in the creation of a cadre of able research leaders. This, we feel certain, is a welcome development for both research and higher education in agriculture and one which should be encouraged on a wider scale.

14.21 There appears to be a tendency in some agricultural colleges and agricultural universities to restrict admission to postgraduate courses in agriculture to agricultural graduates. This, in our opinion, is a very short-sighted policy. Agricultural research cannot thrive without drawing upon the best talent from basic disciplines cognate to agricultural science. Graduates in other disciplines such as chemistry, physics, statistics, botany, zoology, etc., have obviously a great and direct contribution to make to the development of agriculture. Graduates from other faculties such as economics, business administration, engineering, etc., would also be needed and would contribute to research investigations on the assessment and utilization of resources, economic development,

marketing and related fields. We are, therefore, unable to support the existing restrictive practices and urge that talents from as many fields as possible should be harnessed to the betterment of agricultural research and education.

14.22 *Extension.* The agricultural universities should be entrusted with responsibility for the research facilities and programmes of agricultural departments and for extension work which provides the necessary link between new elements of technology developed through research and application to farm practice. This may be begun by entrusting responsibility for research immediately and that for extension progressively through a phased programme. These programmes can be expanded as staff and other resources permit. In their extension work the universities should cooperate fully with the supply services and other programmes and activities of agricultural departments. We shall return to this subject a little later.

14.23 *Undergraduate Teaching.* For the next few years, the principal task of the agricultural universities would be to provide high-level undergraduate education in agriculture. We shall, therefore, say something about its organization.¹⁶⁹ Agriculture, like all other scientific subjects, is rapidly changing. Hence the main educational tasks of the agricultural universities will be the same as for the other institutions of higher education: to give their students a deep knowledge of fundamental principles; an ability to solve new problems as they arise; and the will and ability to continue learning without a teacher throughout their careers. In the agricultural universities, as in other universities, the students should spend a major part of their time in independent study and should be introduced to research as early as possible. The aim of formal teaching should be to give the students a knowledge of the specialized language of the subject being taught, an understanding of its basic principles, an ability to use the relevant literature, and a recognition of the frontiers of knowledge in the field.

14.24 During the first years of their undergraduate courses the students should, in addition to lectures and laboratory work, take part in 'tutorials' or 'preceptorials', review and explanation of lecture materials. Much of their time should be spent in independent study in the library, the laboratory and on the university farm, and in solving technical problems assigned by the instructors. During their last years, the students should spend less time in lectures, review and formal laboratory work and more time on independent studies.

¹⁶⁹ This is also applicable, *mutatis mutandis*, to the other undergraduates teaching in all universities.

14.25 The requirements for independent study cannot be fulfilled unless the university library has a large collection of modern books and periodicals, which are well arranged and easily accessible to the students. The university library will need both an adequate budget for purchasing books and periodicals, and an adequate staff to order, catalogue, sort and file acquisitions, to help students and faculty members find what they need, to maintain proper procedures for taking books on loan, and to weed out obsolescent and useless books.

14.26 The teaching at all stages should de-emphasize cramming and memorization and should be designed to stimulate curiosity, to develop problem-solving ability, and to foster originality. Extra-curricular activities should be stressed, including student competitions, journalism and creative writing, debates, individual and team sports and formal and informal student discussion groups. Each of these activities should have a voluntary faculty adviser who enjoys this aspect of his work.

14.27 In keeping with the findings of other committees, we recommend that the duration of the first degree course should require five years' study after ten years' schooling. It is impossible to be rigid in this prescription because the duration of the course will depend not so much on years of schooling as on the attainments of the average student at the time of his entry into a degree course.

14.28 *Teachers.* The agricultural university must be a community of scientists and scholars in which the faculty members have collective responsibility and authority for academic affairs. In each university there should be groups of able scientists in each field who will work together in preparing curricula, taking special responsibility for the progress of the students, setting standards of student performance, testing and evaluating the students, organizing, developing and using laboratory, library, computer and field facilities, and stimulating each other in research and teaching through seminars, collaborative research and informal relationships. One of the earliest and also the most difficult tasks in the establishment of these universities is, therefore, to get together this band of scientists and scholars. From this point of view, we make the following recommendations:

- (1) The success of these universities will depend on their ability to provide life-time careers and a total environment for their staff members which will attract many able persons in competition with other professions. This will probably mean that, for many of their staff members, there should be a rotation of assignments between classroom teaching and laboratory research, experimental station research, and work in the field with rural people.
- (2) The UGC scales of pay, which have now been revised and

brought on par with those in IITs and CSIR, should be extended to these universities also. These should be subject to periodical revision to ensure that they do continue to attract able men.

- (3) In structuring faculties, the aim should be, as soon as good men can be found, to appoint a number of professors in each field. In the long run, the number of professors, readers and lecturers should be determined by needs and quality of staff and not by a **rigid hierarchy**.
- (4) Part of the undergraduate teaching should be done by the senior professors and part by teaching assistants drawn from the ranks of postgraduate and research students. The paths to faculty promotion should be based on outstanding accomplishment, independent of the accidents of seniority. The criteria for promotion should primarily be accomplishment in research, but first-rate teaching should also be rewarded. Faculty and research staff members should receive sabbatical leave every few years to refresh and renew their understanding of their own fields. Good faculty housing at low rentals should be available on or near the campus. Good schools for the children of the staff should be made available.
- (5) The faculties should have a major voice in choosing their own members, but the selection of new faculty members should be on the basis of wide participation within the university faculties and not simply by the department concerned. Within broad limits established by his fellow faculty members, each teacher in an agricultural university should be free to teach as and what he thinks best. Such freedom in teaching will require that the teacher has major responsibility for assessing his own students. External examinations should be reduced in importance and abolished as early as possible. Staff members should devote only a part of their time to lectures, tutorials or preceptorials, seminars or laboratory teaching. The remainder of the time should be available for research, working with individual students, and working with fellow staff members to improve the quality of instruction, the library collections, the physical facilities, and other problems of common interest.

14.29 It is obvious that to staff the network of agricultural universities as well as the existing agricultural colleges and the proposed agricultural polytechnics, a large-scale programme of teacher training will have to be undertaken immediately. For this purpose, we recommend that five or six existing centres with high standards and facilities be chosen and scholarships offered on a national competitive basis to graduates in science and agriculture for training at these centres with the

assurance of appointment to universities, colleges, polytechnics or extension work on the completion of their training. It may also be necessary, for some time, to send selected students abroad for training. In some cases, even the services of some teachers may have to be obtained from abroad.

14.30 *Students.* It is essential to attract talented students to the agricultural universities. We realize that many other factors such as salary, prestige and avenues of advancement will affect this. But we recommend the following two measures which will greatly help in improving the situation:

- Not less than 25 per cent of the students in agricultural universities should be awarded scholarships on the basis of an all-India test specially organized for the purpose.
- An upward revision should be made of the present scales of pay offered to the agricultural graduates.

14.31 *Farm.* It would be essential that the teaching given be linked to actual practices in farming conditions and in order to do this, well-managed farms, of sufficiently large size (around 1,000 acres and not less than 500 acres of cultivated area) should be attached to every agricultural university.

14.32 *Internship.* In order to provide a sound practical base to the graduates of agricultural colleges, for which there has been a persistent demand, the possibility of making suitable arrangements for a one year's internship on a well-managed State or university demonstration farm before a degree is finally awarded, should be seriously explored. Under present conditions, it is not possible to attach them to progressive farmers for practical training as is done in some countries.

14.33 *Number, Size and Organization.* As we have stated already, there should be at least one agricultural university in a State. In establishing them, the possibility of converting existing universities into an agricultural university may be explored. There has been some experimentation in the organization of the existing universities and not all of them are of the same type. While we are in favour of experimentation, it is essential that all agricultural universities—at least those to be established in future—should conform to some important principles. The most important of these is that they should, as far as possible, be single campus universities which do not have any affiliated colleges. If for special and exceptional reasons the university should take over the responsibility for colleges not on its campus, they should be made constituent colleges of the university under a unified administration.

14.34 As stated earlier, it was not possible for us to obtain any precise estimates of manpower needs in agriculture, except those in the ISI/LSE Paper, which have been reproduced in a later section. These indicate that the agricultural universities will have to train about 250,000 to 300,000 specialists at the graduate and postgraduate levels in a large number of categories some of which are listed below:

1. *Agriculture* (including animal husbandry and veterinary science):
 - University teachers and research workers
 - Polytechnic teachers
 - State and Central Government professional staff
 - District officers and advisers
 - Development Block Extension Officers
 - Development Block Frontier Workers Industry (Graduates)
2. *Engineering*:
 - University and polytechnic teachers and research workers
 - Chemical engineers
 - Irrigation engineers and hydrologists
 - Mechanical engineers
3. *Nutrition and Food Technology*:
 - University and government teachers and research workers
 - Industry
 - Distribution workers
4. *Agricultural Economics*:
 - University and polytechnic teachers and research workers
 - Farm Credit Specialists
 - Marketing Analysts
 - Price Analysts
 - Operational Analysts
 - Crop Insurance Specialists
5. *Public Administration*:
 - University teachers
 - Government officers
6. *Mass Communications*:
 - University teachers
 - Government officers
7. *Sociology, Anthropology, and Law*:
 - University and polytechnic teachers and research workers

Land tenancy reform officers
Village sociologists and anthropologists

8. *Resource Conservation:*

University and polytechnic teachers
Soil survey officers
Erosion control officers
Land and water management officers

9. *Forestry:*

University and polytechnic teachers
Forest management officers
Forest product specialists

10. *Fisheries:*

University and polytechnic teachers
Fresh water pond fisheries specialists
River and lake fisheries specialists
Marine fisheries specialists
Fishing boat and equipment specialists
Fish processing and distribution specialists

11. *Earth Science:*

University and polytechnic teachers
Ground water and engineering geologists
Meteorologists
Physical oceanographers

12. *Basic Science:*

University and polytechnic teachers and research workers
Statisticians for government and industry
Biochemists for government and industry
Physiologists for government and industry
Chemists for government and industry

13. *Humanities:*

University teachers.

AGRICULTURAL HIGHER EDUCATION OUTSIDE THE AGRICULTURAL
UNIVERSITIES

14.35 *Contribution of Universities to Education for Agriculture.* Agricultural universities can and will undoubtedly play a leading role in the

development of education for agriculture. But that is not enough. We would like to urge that the development of agricultural education should be a national concern and should be regarded as a responsibility of the university system as a whole. It is, therefore, necessary to encourage universities in general to develop suitable courses at the undergraduate and postgraduate levels. In this connection, we make the following recommendations:

- (1) The disciplines which impinge and contribute to agricultural development are many, i.e., biology, chemistry, physics, engineering, economics, administration, sociology, law, commerce, etc. Universities should be encouraged to develop courses at the graduate and postgraduate levels in these areas, with special reference to their application to agriculture.
- (2) Universities should be encouraged to strengthen their faculties of agriculture. Care should be taken to see that adequate standards are maintained and that the available resources in men and materials are not scattered thinly over a wide area. Where such facilities exist or are stated by universities, arrangements should be made available to them to work with agricultural experimental stations situated in their neighbourhood and to involve their faculty members and students in extension education and demonstration programmes.
- (3) We also suggest that steps should be taken to establish a close relationship between some of the agricultural universities and the IITs. The possibility of developing a faculty of agriculture in an IIT should also be explored. There could be an organized exchange on a selective basis, of students and staff, and also some common programmes of study and research could be undertaken. There are a number of areas of research, as for example, those concerned with land reclamation, irrigation and water management, crop processing and storage, farm mechanization and tillage, and others where joint work by engineering and agricultural institutions could be of great value.
- (4) The close collaboration in education for agriculture between the agricultural universities, the IITs and the other universities would be greatly facilitated if the same organization, namely the ICAR, is charged with the responsibility of overseeing the development of agricultural education, not only in the agricultural universities but outside them also. The financial support from the ICAR should also be available, not only to the agricultural universities but also for other universities and IITs for the development of education for agriculture. Similarly, the support of the UGC or the UGC-type of organization we have recommended for techno-

logical education should also be available for the development of faculties of natural or social sciences or engineering in the agriculture universities. We emphasize this close collaboration between the UGC and the ICAR which is of great significance for the development of agricultural education.

14.36 Agricultural Colleges. Some agricultural colleges, not forming part of agricultural universities, will continue to be affiliated to the other universities. The general policy in their regard should be on the following lines:

- (1) New agricultural colleges should not be established and the training of undergraduates or postgraduates in agriculture should be done, as far as practicable, in the agricultural universities.
- (2) Where agricultural colleges are constituent colleges of a university, the university concerned may be assisted to develop strong **faculties in agriculture.**
- (3) Every agricultural college should have available a well-managed farm of at least 200 acres on which modern agricultural practices can be demonstrated.

14.37 Some of the affiliated colleges of agriculture are great institutions, e.g., the college at Coimbatore. But several of the affiliated agricultural colleges are weak institutions, especially in Uttar Pradesh. It is, therefore, necessary to adopt a vigorous policy of improvement in their regard. **We recommend that**

- the universities concerned should be zealous with regard to the maintenance of standards in these colleges;
- a system of quinquennial inspection of all agricultural colleges should be instituted as a regular feature and should be done jointly by the ICAR and the UGC. The first such inspection should be undertaken immediately and completed within a year. The universities should be requested to disaffiliate colleges which do not come up to minimum requirements. We think that the reports of these periodical inspections will be very salutary;
- the possibility of converting some of the colleges into institutions offering courses at a higher technical level, instead of a degree, should be explored.

AGRICULTURAL POLYTECHNICS

14.38 As in technical education for industry, we believe that there is great scope in India for the training of skilled workers and middle level technicians in agriculture for the supporting services needed by the

farmer, for assisting in extension work, for many trades and industries based on agricultural products, and in the service trades. We recommend that a vigorous effort be made to establish specialized institutions which will provide vocational education in agriculture at the post-matriculation level and attract large numbers of boys and girls. These institutions may be designated as agricultural polytechnics.

The programme should be developed on a priority basis. The work may begin by courses being added to existing polytechnics located in predominantly rural surroundings. However, for the best development of these and to make the maximum use of scarce resources, we recommend that they should be attached to agricultural universities and that the aim should be to set up some large-scale institutions of this kind in the different States. These may begin modestly but should grow into institutions with enrolments around 1,000 or even more. We would like to emphasize that, in vocational education, small institutions are particularly uneconomic and tend also to be inefficient.

14.39 These institutions will be responsible for training the non-professional specialists required as farm mechanics, farm managers, laboratory assistants, craftsmen and technicians in agro-industries, assistants in agricultural credit and insurance organizations, assistants in extension services, self-employed craftsmen and technicians to work in the rural areas, and field representatives of fertilizer and pesticide manufacturers. They should also organize short intensive courses for farmers in such subjects as bee-keeping, seed production, etc.

14.40 The polytechnics should be multipurpose institutions providing a wide range of training in specialized courses related to the above range of skills as they are needed in animal husbandry, horticulture, processing, forestry, crop production, etc. The courses should be predominantly of a diploma character demanding up to three years' study, depending on the level of specialization required. Some craftsmen courses should also be organized for those who have less than matriculation qualifications and for these, certificates may be given. A list of some diploma certificate courses is annexed to this chapter. It will not of course be possible for any one polytechnic to offer all of them. The curriculum of each institution will be dictated by the conditions in the region it seeks to serve. The courses should, as recommended by us for industrial polytechnics, be directly practical in nature and require a significant period of practical experience.

Each polytechnic should have a large-scale, well-managed farm attached to it with facilities to demonstrate a full-range of mixed farming. It should have well-equipped laboratories for science teaching, and small processing plants for practical courses in food and other product-processing.

14.41 When well established, these polytechnics should offer short condensed courses for the young farmers. We also emphasize the need for designing courses of special interest to girls and women in rural areas. The importance of this, particularly in relation to applied nutrition in changing present dietary habits and in programmes of dairy or poultry development which are mostly managed by women in rural households should be obvious.

14.42 It will be necessary to ensure from the beginning that the highest standards possible are maintained and pursued. This will be principally the responsibility of the agricultural universities to whom these polytechnics will be attached in a broad way, and they should take immediate steps within the framework of the teacher training programmes, proposed later, for the recruitment and training of high-level instructors required for manning the polytechnics. This would be facilitated if attractive scales of pay and adequate qualifications are prescribed for the staff of these institutions.

14.43 As with other types of vocational education, possibility should exist for the exceptional student, through further study, to take up courses in higher education. But again it is necessary to emphasize that the courses offered should be predominantly terminal in character leading to a specific employment. In order to make this effective, attention will have to be given to the status and scales of pay of diploma and certificate holders who graduate from these polytechnics and efforts will be needed by both private and public employers to ensure that such careers are made attractive.

AGRICULTURAL EDUCATION IN SCHOOLS (CLASSES I—X)

14.44 The agricultural polytechnics will function at the higher secondary stage. But one of the important questions raised before us was whether or not agricultural education should be developed at the higher primary or the lower secondary stage also. We have examined this problem very carefully and have come to the conclusion that attempts to train for vocational competence in farming through formal schooling in agriculture at the primary and lower secondary levels have failed and further efforts should be held in abeyance. In view, however, of the widespread belief that this should be done on a large scale, the problem needs closer examination.

14.45 *Present Position.* It may be desirable to recapitulate briefly the various kinds of institutions and types of training offered at present at this level and aimed at imparting vocational competence in farming.

(1) *Primary level.* With the development in many States of the concept of basic education with its emphasis on concurrent training in a craft, agriculture has been introduced as one of the primary crafts in junior and senior basic schools, especially those located in rural areas. In Uttar Pradesh, for example, in 52,654 junior basic schools (up to Class V) agriculture is the principal craft while at the senior basic stage (up to Class VIII) 2,538 institutions offer agriculture as a basic craft. It is to be noted, however, that at the junior basic stage no separate teacher for agriculture is provided while at the senior basic stage, one teacher (agricultural graduate) is provided. In Gujarat also, agriculture is the primary craft in basic schools located in rural areas. In Maharashtra, in spite of the efforts of the Government less than a quarter of the basic schools and less than 5 per cent of primary schools in the State offered agriculture as a craft. Agricultural education at this level seems to be less developed in other States of India.

(2) *Lower Secondary level.* At this level a variety of courses in agriculture are offered, with different objectives in view.

(a) First are the vocational schools or agricultural schools, which take pupils who have completed their primary education and give them a vocational training with the objective of preparing them as practical agriculturists. These vocational schools are modelled on the *Manjiri* type offering a two-year diploma course. Maharashtra has especially gone in for this type of schools. It has one such school in each district of Western Maharashtra and more schools have been proposed in the Fourth Plan. These schools appear to be fairly well equipped and well staffed (with six agriculture-trained teachers) and there is a steady demand for admission in them, the stipend and prospects of ready employment in the Department being the main attractions. The stated objective of these schools—training sons of farmers who would go back to the land—however, is completely unrealized.

(b) In several high schools, courses in agriculture are offered either to fulfil the requirements of introducing a craft or as one of the subjects which can be elected to fulfil the requirements for matriculation. It has been stated that, in some areas, the choice of agriculture is an alternative to subjects like history and Sanskrit and not mathematics or science. In U.P. there are 160 high schools offering agriculture as an optional subject. In Maharashtra, 88 (or about 3 per cent) high schools and in Madhya Pradesh, a number of higher secondary schools offer agriculture as a subject. In Gujarat, a few privately run post-basic schools offer courses in agriculture.

(c) Agriculture is also offered as one of the streams in multipurpose high schools. In 1960-61, there were more than 2,000 such schools though their number does not appear to have substantially increased

later. The total curricular programme is based on a common core programme including a craft for all streams. The agriculture stream envisages two types of options, one (college preparatory) academic in content and requiring chemistry, biology or physics and mathematics and another (employment preparatory) vocationally biased course which calls for practical agriculture, applied mathematics and applied science. Both groups are expected to take a common basic course in agriculture composed of (i) agricultural economics and rural sociology; (ii) plant science and production; (iii) animal science and production; and (iv) agricultural engineering and technology, approximately half the total time being devoted to this common course.

14.46 *Recommendations.* None of these courses or programmes have succeeded in imparting the needed vocational competence or in training young persons who will go back to the land as practising farmers. We therefore recommend as follows:

- (1) The introduction of agricultural education at the primary school level is not, in our opinion, likely by itself to achieve the objectives of inculcating a liking for agriculture as a way of life or of halting migration of rural people from the land, as is often claimed. Rural-urban migration depends on the interaction of many socio-economic factors of which education is one, and probably a minor one at that. The type of education as at present given in such schools often results in meaningless drudgery and can well serve to instil a distaste for agriculture in the minds of the young students. Adapting the rural boy to his environment is, however, a different matter and, as we have recommended earlier, can be best achieved by giving an orientation towards agriculture as part of the whole educational system.
- (2) The same broad conclusion will be valid at the lower secondary stage also. It has been the opinion of most people contacted by us that the training given in institutions of formal education does not lead to vocational competence. It appears rather unlikely that in a field like agriculture, vocational competence can be given in a period of two or three school years. Farming implies hard work and mature judgment and the age-group concerned (13+ to 16+) is neither physically nor mentally prepared for this. We also think that over-specialization at an early age is not at all desirable. Nor are we convinced that the narrowly vocational training is the best use that could be made of school time. As has been made clear at several places in the chapter, massive application of scientific knowledge and skills is basic to the modernization of our agriculture. We recommend, therefore,

that the period which can be spent in school should be utilized in imparting a sound general education, with particular emphasis on mathematics and the sciences. This, we feel, would be the best preparation for coping with the rapid changes that are bound to characterize our agriculture in the future. It is because of these and other considerations that we have been unable to endorse the organization of formal courses in the schools for educating the primary producer.

14.47 It might be pertinent in this connection to refer to the interim proposal formulated by a Working Group of the Ministry of Education to set up 2,000 junior agricultural schools, with an enrolment of 400,000 students in the course of the Fourth Plan, at a cost of Rs. 750 million. These schools, apparently based on an analogy with the junior technical schools, aim, as their basic objective, at training a cadre of intelligent and enthusiastic farmers who can adopt improved farming practices. In fact they are expected to produce 'not wage earners but self-employed agriculturists'. We have carefully examined the proposal outlined by the Group but we do not think that the scheme can be successfully implemented or that its stated objectives will be attained. Apart from the difficulties of finding adequate and suitable land and staff, we are not convinced that the scheme as proposed will, in fact, endow the trainees with vocational competence. As stated above, the age-group involved would be physically and psychologically unprepared for training in a demanding profession like farming. Furthermore, there does not appear to be any appreciable difference, except in the increase in agricultural practicals (and most of that in Class IX when the students may be only 14+) from the agricultural stream in multipurpose high schools which are justly considered to have been failures by the Working Group itself.

14.48 In our opinion, it is unrealistic to expect that persons with an education so much better than the majority will in the present socio-economic set up, remain on the land. Till the desire to remain on the land can be strengthened appreciably, through improved economic opportunities and attractive amenities, the attempts to create motivation to take to formal agricultural education by stipends, admission preference, etc., will not go far in achieving the objective of producing self-employed agriculturists. Indeed, the implementation of this costly scheme may well mean that scarce resources are spent on training those who are likely to be diverted into other avenues while those who will remain on the land would be denied such training.

14.49 We feel, therefore, that the proposal for setting up a large number of junior agricultural schools presents several difficulties and may fail to achieve its stated objectives. We recommend that it should

be abandoned. There will, of course, be a pressing need to train middle level functionaries in extension, industry, etc., but these can be better produced by the agricultural polytechnics which we have recommended.

AGRICULTURAL EDUCATION AS PART OF GENERAL EDUCATION

14.50 This does not mean, however, that the school system till the end of the lower secondary stage (which is mainly one of the general education) has no contribution to make to the development of agriculture. On the contrary, we believe that some orientation to agriculture should form an integral part of all general education, not only at the school stage, but also at the university stage and in all teacher education. Given the economic importance of agriculture in our country, every citizen, irrespective of his residence, occupation or status should be made aware of the problem of agricultural and rural life and, in short, receive an agricultural orientation as part of his education. This will mean an awareness of the problems of the farmer, some appreciation of the skills needed in farming and of the new horizons and possibilities opened up by science and technology. Such general agricultural orientation should lead, not only to the awakening of interest and consequent diversion of many young people to agricultural careers, but also to better realization by future policy-makers of the importance of the well-being of the primary producer for the improvement of agriculture and the general economic betterment of the nation.

14.51 We, therefore, recommend the following:

- (1) All primary schools including also those situated in urban areas should give an agricultural orientation to their programmes. We do not intend by this recommendation to add to the academic burden. Indeed, we are convinced that this does not require a special agricultural course but only orienting existing courses in general science, biology, social studies, mathematics, etc., towards the rural environment and the problems facing the Indian community.
- (2) Agriculture can be made an important part of work-experience which we regard as one of the essential components of a national system of education. This can be made exciting and stimulating to the young mind and should not be meaningless drudgery in the name of agricultural training, especially in the earlier years, leading to a life-long aversion to agriculture as a way of life.
- (3) A similar orientation towards agriculture should be continued in the lower and higher secondary stages and should form a part of work-experience at these levels as well. Science and social

studies syllabuses should contain elements of agricultural and rural problems.

- (4) Appropriate colleges and university faculties should include some staff members and research scholars who are interested in the role their speciality can play in modernizing agriculture. Undergraduate and postgraduate courses in colleges and universities should also give prominence to an orientation to rural and agricultural problems. One way to do this would be to set some papers in agricultural subjects which would be open to students to take as part of their course. The experience of the rural institutes in this field can be useful and should be fully utilized. The UGC and other university authorities should take suitable steps towards bringing about such orientation.
- (5) Similar orientation to agriculture and rural problems should also be introduced in all teacher training programmes.

EXTENSION PROGRAMMES

14.52 *The Problem.* Clearly the most immediate task for agricultural education is to transmit to farmers the technical information now available which will enable them to increase their yields and their family incomes. At first sight, this task seems overwhelming. There are some 60 million farm families in India and at least 85 per cent of them are functionally non-literate. One way to make progress, therefore, is to concentrate on the forward-looking and progressive farmers who probably are to be found amongst the third of the cultivators who now own more than half of the agricultural land. Given the large-scale illiteracy even among this group, the work will have to be based mainly on demonstration at convenient centres. Further demonstration by the farmer himself within the village and the use of radio broadcasts, simple posters, etc., can carry the message further.

14.53 If agricultural extension is to succeed in the present conditions, three main changes are needed:

- The first is to upgrade the skills of extension workers. For this purpose, the training programmes of extension workers will have to be improved so that the new recruits to the cadre have adequate competence. In addition, re-training programmes will have to be devised for the persons who are already in service.
- The second is to separate extension work proper from the supply services of the Agricultural Departments. Experience has shown that the officers concerned have hardly any time for extension work when both these functions are combined.
- The third is that extension workers should be attached, not to

offices, but to research centres or demonstration farms. This would enable them to carry on extension work by example rather than by precept and the farmer will, in his turn, feel greater confidence and trust in their competence to advise him.

14.54 Upgrading Skills of Extension Workers. The need to upgrade the skills of extension workers is now generally recognized and the Ministry of Food and Agriculture has several plans for this purpose. The Village Level Worker (VLW) or *Gramsevak* is a very important part of the machinery of agricultural development since it is he who comes into close contact with the farmer and the effectiveness of agricultural extension work depends to a large extent on his efficiency. It is widely admitted now that the VLW has not been able to have the expected impact on agricultural production in the country. This was partly because of the tendency in earlier years to consider him a general development man and load him with all sorts of non-agricultural work. The lack of professional competence of the VLW aggravated this situation since he often preferred to devote most of his time to general development work where he felt less inadequate. The Ministry of Food and Agriculture proposes to take remedial action along two fronts—by relieving the VLW of a major part of the general development work and by improving his professional and technical competence. Various proposals are under consideration to recruit better qualified persons, even agricultural graduates, for these positions in the future, particularly for the districts selected for intensive agricultural development. It may not, however, be easy to recruit and retain the required number of well-qualified people under the present pay scales and other conditions of service. The efficiency of the VLWs who are in position already will also have to be upgraded, if the large needs are to be met, especially in the short run.

14.55 The problem of improving the technical competence of the existing VLWs is a complex one partly because of the large numbers involved and partly because of the heterogeneous nature of the training they have had. In view of this, the Ministry of Food and Agriculture proposes to adopt a multi-pronged approach towards improving their professional competence.

(1) Such of the VLWs as satisfy the requirements for university entrance are to be deputed in a phased programme to prepare for the B.Sc. (Ag.) degree. It is expected that some 2,500 VLWs will be sent for B.Sc. (Agri.) courses during the Fourth Plan. The Ministry is conscious of the need to hold those who have been given higher training in their jobs and proposes to give such trainees a higher salary and better prospects.

(2) The Ministry also proposes to upgrade the Gramsevak Training Centres (GTC's) by endowing these with better staff, equipment and facilities so that higher training can be provided to selected *gram-sevaks* to improve their professional competence and effectiveness. This is to be done by providing a one-year advanced course to selected VLW's in various aspects of agriculture and animal husbandry. Twenty centres have already been upgraded and the Ministry proposes to upgrade all the 100 GTC's during the Fourth Plan at a cost of Rs. 55 million.

(3) The Ministry also proposes to intensify the refresher training programme of VLW's. This in-service training programme which is at present confined to 20 GTC's will be extended to all the 100 GTC's; two months' refresher courses will be organized and all the 60,000 VLWs in position will receive this training at least once in the course of the Fourth Plan period. There are also proposals under consideration for imparting in-service training to VLWs through study tours.

(4) In order to equip selected VLWs with specialized knowledge in certain important fields, the Ministry has formulated a scheme for the organization of specialized training courses in such fields as soil conservation, agricultural implements, poultry keeping, plant protection, horticulture, etc. There will be 25 such centres giving six-week courses and it is expected that 15,000 VLWs will receive such specialized training in the course of the Fourth Plan.

(5) The Ministry has also plans for giving in-service refresher training to extension officers at the State, region and district levels, as also to the instructors at the GTC etc., as well as improving the professional competence of the officers working in the Departments of Agriculture and Animal Husbandry.

All the above programmes will necessarily mean drawing away people from their position in the villages. To make this possible, a training reserve of 10 per cent of the existing strength of VLWs is proposed to be created.

14.56 There can hardly be any doubt of the importance of the effort to raise the professional and technical competence of the VLWs and of the specialists who support them. We hope that the various proposals of the Ministry listed above will go a long way to meet the desired objective. The agricultural universities will obviously have to play an important role in this by making available the specialist staff needed and by structuring, if necessary, special courses which will round off the technical competence of the VLWs, taking into account the training and the experience they have already had. The agricultural polytechnics visualized by us would, when they are set up, also be able

to play an important role in offering specialized training with a practical bias in suitable areas.

14.57 *Separation of Supply Services from Extension Work.* We were also given to understand that the separation of supply services from extension work proper is to be carried out. We welcome this move and recommend that as and when this separation takes place, the extension part of it should be transferred to the agricultural university. For the success of extension work, however, there should be the closest liaison between the extension work and the supply and other programme services of the Departments of Agriculture. It will serve little purpose to demonstrate the use of fertilizers, improved seeds, better irrigation, drainage, etc., if the farmer does not have ready access to the needed credit, insurance, seeds, water, fertilizers and pesticides on which such practices depend. The extension workers should not themselves be involved in this work, which will take them away from their farming demonstration and back to administrative work in an office. But they should maintain a close and constant contact with their colleagues responsible for this work.

14.58 *Establishment of Primary Extension Centres.* The most important change, however, is to locate the extension workers on farms run on modern lines. In our opinion, a good way of developing extension services in a community development block is to establish a good farm of adequate size which would adopt improved methods of agriculture and be run on a commercial basis. The very existence of such a farm within easy distance from the home of every farmer where he can see better agriculture being practised and made to pay would, in itself, be extension work of very great significance. If in addition there are persons attached to these farms who have been trained in modern methods of agriculture and the new techniques of mass communication, the value of such a farm for extension purposes would be considerably enhanced. We propose to designate this farm as a Primary Extension Centre. It may be a research station, a demonstration farm or a seed farm or may even be established for the sole purpose of extension.

14.59 We, therefore, recommend that at least one primary extension centre should be set up in every community development block for purposes of extension work. We realize that this cannot be done all at once. We, however, suggest that a beginning may be made wherever the necessary land and facilities are available. Some of the existing small research stations, demonstration or seed farms may be utilized for this purpose; and the objective of policy should be to cover all the

community development blocks, in a phased programme spread over a period of ten years. To these primary extension centres, leading and progressive farmers from each village in the block should be brought for demonstration, information and advice. These centres should be within cycling distance of the area they are serving. Farmers should be expected to attend them at convenient times and a simple midday meal should be offered, slightly better than at home, which itself may be used as an occasion for advice regarding nutrition and dietary changes.

14.60 These centres can also be utilized for giving part-time agricultural education to young persons who have left school and have adopted agriculture as a vocation. It will be recalled that we have emphasized this programme.¹⁷⁰

14.61 In most places where the primary extension centres would be located, there would be a secondary school also and at any rate, a higher primary school. It will be very desirable to associate such local schools with the primary extension centre with the object of providing guidance to the teacher and giving orientation in agriculture and work-experience to the students. Wherever possible, these high schools should be polarized round agriculture just as technical high schools (which are discussed in the next chapter) are polarized round technology.

14.62 These centres should be manned by two or three agricultural graduates assisted by some of the diploma and certificate holders coming from the polytechnics. They should be administratively linked to the agricultural universities and polytechnics and should be able to call on their staff and research facilities for the information and advice they give. Research workers at agricultural universities should be available to visit the farms of the participating farmers to give any specialized advice that may be required regarding the use of new crops, the control of diseases, etc.

14.63 In order to carry out this work effectively, it would be necessary for the agricultural universities to have strong extension departments. These departments should be able to call on the appropriate faculties and specialists of the entire university staff, all of whom should have some responsibility for extension work. The extension department should be skilled in translating the research results into instructional material and farming practice that can be made available to the staff of the primary extension centre for transmission to the farmers. It will be of the highest importance for the success of these centres that the staff manning them have a practical knowledge superior to the farmers they are educating and that each centre receives the strongest support and guidance from the extension service of the agricultural university.

¹⁷⁰ Vol. II, Chapter VII.

14.64 In addition to the demonstration and teaching given within the extension centres, the staff may organize conducted demonstration tours of the work of successful farmers.

14.65 *Liaison with Successful Farmers.* The Commission recommends that a greater use be made of successful farmers in the carrying out of extension work and in education about agriculture generally. We believe that it would contribute greatly to raising the status of successful farmers if educational and extension authorities were to give recognition to their services to the country. This can be done in a variety of ways and we hope that questions regarding standards of education would be set aside and the value of the practical farmer, who may have no certificate or degree, would be recognized in imaginative ways. We suggest that the staff of the extension centres encourage successful farmers themselves to give talks and demonstrations of their methods. The agricultural universities and polytechnics might also invite these farmers to come and discuss their problems and their successes with the staff and students of these institutions. The primary extension centres may organize some simple prizes and awards for success in new farming practices, and suitable village celebration can be undertaken to promote public esteem for the good farmer.

14.66 The individual village farmers attending courses at the primary extension centres should, as proposed by the Ministry of Food and Agriculture, also be encouraged to start Farmers' Study Circles in their villages. The spread of this extension work will mainly come from the success of the individual farmer and the imitation of his methods by other farmers in the village. The farmer being educated can, however, help in this process, once interest has been aroused, by organizing groups to study the methods that he has adopted. He should be able to call on the help of the staff of the extension centre to give occasional talks to the group. He should receive support and guidance from the extension services of agricultural universities. On occasions he should also be visited by the teaching and research staff of the agricultural polytechnics and universities. As more and more farmers agree to adopt the new practices, a link with the supply and other programme services of the Agricultural Departments to these farmers should be ensured.

14.67 In addition to the above, and as we have already suggested, fullest use should be made of the possibilities of radio and films in educating farmers and rural communities as these media do not depend on literacy for their success. The extension departments of the agricultural universities and Agricultural Departments should work in harmony with the authorities of All-India Radio to ensure that radio

broadcasts are closely linked with the extension work being promoted by the primary extension centres and their agencies.

MANPOWER NEEDS

14.68 *Proposals of the ISI LSE Paper.* It has not been possible for us to form any exact estimate of the manpower needs of agricultural development. This is a neglected area which needs detailed attention. At present, the Government itself is the largest employer of trained agricultural workers; and while some estimates can be formed of the needs in this sector, it is not possible to forecast with any accuracy the needs of agro-industries proposed to be developed, nor of young persons who would take to agriculture as a vocation. The only estimate we have is that given by the ISI/LSE Paper¹⁷¹ which deals with trained agricultural graduates only and does not provide estimates of diploma holders from polytechnics. We reproduce it below for ready reference:

At present agricultural graduates are employed mainly in technical services; even here they are relatively few. In 1960-61 these were about 14,000 agricultural graduates—just over 1 per cent of the total number of graduates in the country. Their exact disposition was not known but Table 1 (p. 670) shows the estimated number of posts for which an agricultural degree was required.

The largest single number of graduates is now employed as Agricultural Extension Officers (AEOs) at the block level; and requirements at the block level and below will continue to be a major determinant of the number of graduates needed. At present there are five AEOs per block in districts participating in the Intensive Agriculture District Programme (IADP) and not more than one or two in the other districts. The 4th Plan Working Group on Agricultural Administration and Personnel and Education and Training have recommended that by 1976 there should be five agricultural graduates in every block and by 1986, ten. The proposals of the 4th Plan Working Group on Employment and Training are broadly consistent with these proposals.

Further ahead it is not easy to forecast the pattern of services accurately. At present there are some 50,000 Village Level Workers (VLWs) or roughly one per ten villages. These are mostly matriculates with one or two years' further training in agriculture and other subjects. The Agricultural Personnel Committee (1958) recommended one VLW per five villages only and that the VLW should be an agricultural graduate. This would require some 100,000 agricultural graduates. Various other ideas have been put forward for disseminating

¹⁷¹ Vol. I, see Chapter V.

modern methods in the villages. It has been suggested for example that a limited number of agricultural graduates (say one per ten villages) should be set up with land on which they could demonstrate these methods, and should also be made responsible for the sales of modern inputs in their areas (perhaps receiving some bonus related to the volume of sales).

It is not necessary here to make any particular assumption about the pattern of services, but only about the density, of agricultural graduates. We can assume that by 1986 the present 50,000 VLWs will have been upgraded in some way. Some will have obtained agricultural degree. Others will have taken a variety of courses. We shall not include these people (however upgraded) in the figures which follow. In addition, taking our cue from the Agricultural Personnel Committee, we assume there should be another 50,000 qualified workers at village level who should be agricultural graduates. There should also be another 50,000 graduates at block, district and State levels, providing specialist services, running district experimental farms, seed farms and so on.

By comparison with services at the lower level, the needs in research and other technical services will be relatively small. But substantial increases may be expected in the number of agricultural graduates required in fields like administration, cooperation and agro-industries. An allowance has been made for this ...

Quantifying the needs of agricultural graduates in secondary schools (including teacher training) requires some broad assumptions. Taking all education (specialized and general) at the level of Classes VIII—XII, we assume that on an average, education in agriculture and related subjects would take up well over 2 hours a week in an average week of roughly 30 hours. We assume that at least 2 hours should be taught by an agricultural graduate. Thus out of 1,500,000 teachers at this level one in fifteen (i.e., 100,000) should be agricultural graduates. An alternative approach is in terms of institutions. The average secondary school is unlikely to have more than 15 teachers teaching Classes VIII and above. If one of these teachers, on the average, is to be agricultural graduate, this will require 100,000 such teachers. Some schools will have more; some will have none. But this figure seems to be a minimum for which to plan.

A critical question, however, is how to persuade agricultural graduates to enter teaching. In general it is unlikely that a large number of technically trained graduates will be willing to teach their subject to children unless some of them have been oriented towards teaching throughout their course. It thus seems worth while considering the development of teacher training courses on a large scale in agricultural

colleges. The salaries which can be offered in schools will also be important.

Most farmers will finish their education in high school or earlier, but it is certain that, as farm incomes rise with increased agricultural output, progressively more of the successful farmers will seek an agricultural education for their sons. Equally, farms will be unable to increase their output through the use of modern techniques unless an increasing proportion of farmers are technically trained. At present the number of farmers who are agricultural graduates is negligible. To estimate the pattern of future demand is not easy but it seems reasonable to think that by 1986 the potential incomes of farms over 15 acres in size will be large enough to provide opportunities for stimulating work and reasonably high income to agricultural graduates; and a sizable number of such graduates may be expected to be engaged in farming by that time. Despite the favourable economic outlook, the induction of graduates in farming must necessarily be a slow process, limited by the rate at which farm ownership passes on from one generation to the other and the prevailing very low proportion of graduates among farm youths. At present there are nearly 6 million farms of 15 acres or more (out of 50 million farms). If we assume that ownership will change at 3 per cent a year this means nearly 200,000 new farmers inheriting such farms each year. It seems reasonable to think that by 1986, 1 in 50 of these may be an agricultural graduate. Allowing for a steady growth up to that time, we should have a total employment of some 50,000 agricultural graduates in farming or farm management by that time. A figure of this kind is highly conjectural but the category itself will be important.

After allowing for the teachers in agricultural colleges, we arrive at a total requirement of 305,000 agricultural graduates in 1986 (see Table 2 on p. 670). This compares with our estimated requirement of 873,000 graduate engineers and can hardly be regarded as excessive. It may be argued that some of the jobs to which we have been ascribing agricultural graduates could be done by lower level personnel. This is possible, but arguments which tend to lower the intellectual status of jobs connected with agriculture are often too readily accepted and need to be examined with care ...

14.69 Recommendations. These estimates are likely to be on the high side, particularly for teachers and practising farmers. At any rate, it will not be possible to produce so many graduates, if reasonable standards are to be maintained. We, therefore, recommend that—

- (1) steps should be taken to form more accurate estimates of the requirements of manpower needed for agricultural development—

TABLE 1. ESTIMATED NUMBER OF JOBS FOR WHICH DEGREE IN AGRICULTURE IS REQUIRED: INDIA (1961-86)

	1961	1986
Agricultural development and extension	9,780	100,000
Agricultural research	2,976	10,000
Others (excluding farming and teaching)	1,342	10,000
Farming . . . . .	..	50,000
Teaching: secondary level . . . . .	..	100,000
Undergraduate and above	1,872	35,000
TOTAL	15,970	305,000

TABLE 2. ESTIMATES OF AGRICULTURAL GRADUATES

	1960-61	1975-76	1985-86
1. Total stock of agricultural graduates (in 000's)	14	94	305
2. Percentage to total stock of all graduates	1.02	2.8	4.7
3. Output of agricultural graduates (in 000's)	3	13	42
4. Percentage to total output of all graduates	2	3	5

separately for graduates and diploma holders and to revise them from time to time;

- (2) pending the availability of better estimates, it may be assumed that upwards of 200,000 agricultural graduates may be needed over the next twenty years and about the same number of diploma holders; and
- (3) the most vigorous efforts will have to be made to increase the output of agricultural graduates and diploma holders over the next ten years—the minimum target being to double the output of graduates and to produce an equal number of diploma holders.

THE ROLE OF THE ICAR

14.70 On the basis of a report by a high level committee of experts, the Indian Council of Agricultural Research (ICAR) has recently been reorganized. Research in agriculture, the responsibility for which had

previously been divided among several organizations, has now been brought together in the Council whose control and direction has been placed under a Director-General, who is a professional agricultural scientist, and Central support for research in agriculture is to be channelled through the Council. The Commission welcome these developments; in fact we look forward to the establishment of strong research councils of this type in most Ministries of the Government of India whose main function would be the promotion of research in the fields in which the Ministry is interested.

14.71 We have recommended that UGC-type bodies should be set up for agricultural, engineering and medical education.¹⁷² In so far as agricultural education is concerned, we feel that this function can best be carried out by the ICAR which can give it the impetus it requires in the immediate future and ensure that agricultural education is developed on the basis of an integrated approach to teaching research and extension. To enable the ICAR to carry out this work effectively, it would be desirable for it to set up a special standing committee which can meet frequently and deal expeditiously with all the developmental work needed in higher education and research in agriculture. The head of this standing committee should be, as with the UGC, a scholar or scientist of national repute. It should also have some overlapping membership with the UGC. Frequent meetings between the chairman of this Standing Committee and the chairman of the UGC should also take place. We trust that fruitful ways will be found for cooperative action by the UGC and the ICAR in the development of higher education in agriculture.

¹⁷² Chapter XIII.

ANNEXURE

14.72 COURSES IN AGRICULTURAL POLYTECHNICS

A. Diploma Courses which may be offered at Agricultural Polytechnics.

(1) Diploma in Integrated Agriculture; (2) Diploma in Farm Management; (3) Diploma in Crop Husbandry; (4) Diploma in Crop Improvement; (5) Diploma in Plant Protection; (6) Diploma in Seed Production and Processing; (7) Diploma in Soil Health and Fertility; (8) Diploma in Laboratory Techniques; (9) Diploma in Storage of Agricultural Products; (10) Diploma in Fruit Production; (11) Diploma in Vegetable Production; (12) Diploma in Gardening; (13) Diploma in Irrigation and Drainage; (14) Diploma in Agricultural Civil Engineering; (15) Diploma in Processing of Farm Products; (16) Diploma in Processing of Horticultural Products; (17) Diploma in Farm Machinery—Use and Maintenance; (18) Diploma in Poultry Husbandry; (19) Diploma in Processing of Poultry Products; (20) Diploma in Animal Husbandry; (21) Diploma in Livestock Health; (22) Diploma in Processing of Livestock Products; (23) Diploma in Dairying; (24) Diploma in Processing and Distribution of Milk and Milk Products; (25) Diploma in Refrigeration and Cold Storage; (26) Diploma in Forestation Practices; (27) Diploma in Forest Conservation; (28) Diploma in Forest Civil Engineering; (29) Diploma in Wood Technology; (30) Diploma in Carpentry and Joinery; (31) Diploma in Forest Tree Improvement; (32) Diploma in Fisheries—General; (33) Diploma in Navigation; (34) Diploma in Fishing Machinery Operation and Maintenance; (35) Diploma in Processing of Fisheries Products; (36) Diploma in Meteorology; (37) Diploma in Communication; (38) Diploma in Agricultural Extension; (39) Diploma in Education; (40) Diploma in Agricultural Economics; (41) Diploma in Rural Sociology; (42) Diploma in Sericulture; (43) Diploma in Apiculture; (44) Diploma in Pig Husbandry; (45) Diploma in Sheep Husbandry; (46) Diploma in Wool Technology; (47) Diploma in Chemistry of Farm Products; (48) Diploma in Applied Microbiology; (49) Diploma in Marine Engineering; (50) Diploma in Food Technology; (51) Diploma in Food Inspection, Analysis and Hygiene; (52) Diploma in Health Visiting; (53) Diploma in Nutrition; and (54) Diploma in Home Science.

B. Different Subjects which might be taught in Agricultural Polytechnics.
Appropriate combination of these might be required to satisfy the re-

quirements of the various courses mentioned above. (1) General Agriculture; (2) Integrated Agriculture; (3) Soil Health and Soil Fertility; (4) Production of Field Crops; (5) Seed Production and Processing; (6) Crop Improvement; (7) Farm Management; (8) Farm Business; (9) Plant Protection—Diseases; (10) Plant Protection—Pests; (11) Use and Properties of Fungicides; (12) Use and Properties of Pesticides; (13) Agricultural Surveying and Levelling; (14) Water Use in Agriculture; (15) Agriculture Construction; (16) Land Reclamation; (17) Processing of Farm Produce; (18) Livestock Health; (19) Livestock Maintenance; (20) Livestock Nutrition; (21) Livestock Breeding; (22) Poultry Maintenance; (23) Poultry Health; (24) Poultry Nutrition; (25) Poultry Improvement; (26) Pig Husbandry; (27) Processing of Livestock Products; (28) Processing of Egg and Poultry Products; (29) Processing of Milk and Milk Products; (30) Processing of Piggery Products; (31) Chemistry of Farm Produce; (32) Sericulture—Silkworm Egg Production; (33) Sericulture—Mulberry Culture; (34) Sericulture—Silkworm Diseases; (35) Sericulture—Silk Reeling and Weaving; (36) Mulberry—Pests and Diseases; (37) Silkworm Improvement; (38) Applied Microbiology; (39) General Horticulture; (40) Olericulture; (41) Pomology; (42) Horticulture; (43) Gardening; (44) Landscape Gardening; (45) Forestation Practices; (46) Forest Conservation; (47) Forestry Civil Engineering; (48) Forestry Economy; (49) Forest Tree Improvement; (50) General Forestry; (51) General Fisheries; (52) Marine Biology; (53) Oceanology; (54) Climatology and Meteorology; (55) Fishing Craft—Construction and Maintenance; (56) Navigation; (57) Maritime Law; (58) Fishery Practice; (59) Fishery Law; (60) Fisheries Manufacture; (61) Fisheries Microbiology; (62) Fishing Machinery; (63) Cold Storage and Refrigeration; (64) Processing of Fishery Products; (65) Wireless Communication; (66) Embarkation Practice; (67) Electric Theory; (68) Wood Technology; (69) Logging and Wood Transport; (70) Farm Machinery—Principles and Design; (71) Farm Machinery—Use and Maintenance; (72) Metallurgy; (73) Extension Education; (74) Educational Psychology; (75) Rural Organization; (76) Rural Sociology; (77) Cookery; (78) Bakery and Flour Confectionary; (79) Dietetics; (80) Home Management; (81) Millinery; (82) Needle-work and Embroidery; (83) Tailoring; (84) Upholstery; (85) Weaving; (86) Applied Biology; (87) Applied Chemistry; (88) Applied Physics; (89) Applied Mathematics; (90) Ecology; (91) Statistics; (92) Catering; (93) Human Health; (94) Geology; and (95) Soil Science.

C. A Sample of Certificate Courses which might be offered in Agricultural Polytechnics. (1) Agricultural Kamgars of Various Types; (2) Nursery Assistants; (3) Malis; (4) Grading, Packing, etc., of Farm Produce;

(5) Food and Fruit Produce Processing; (6) Dairying Processing; (7) Fisheries Operatives; (8) Tractor Operatives; (9) Tubewell or other Appliance Operatives; (10) Poultry Keepers; (11) Egg Graders and Packers; (12) Egg Processing Assistants; (13) Pig Husbandry Assistants; (14) Dressers for Livestock; (15) Wool-handlers and Shearers; (16) Carcase Utilization Assistants; (17) Laboratory Attendants; (18) Storage Assistants; and (19) Forestry Assistants.

SUMMARY

1 A programme of education for agriculture will have to be based on an effective organic link between the three main elements of teaching, research and extension. 14.01-06

2 *Agricultural Universities.* At least one agricultural university should be established in each State.

(1) Beginning with traditional agricultural specialities, these universities should gradually extend their scope of studies to cover a wide range of specialized courses to suit the needs of the day.

(2) A clear delineation of responsibilities between agricultural universities and the State Departments of Agriculture is necessary. The former should take over all research, education and extension programmes.

(3) Postgraduate work should become a distinctive feature of the Agricultural Universities which should be staffed with adequately trained personnel. The intake at the postgraduate level, particularly in the hitherto neglected areas, will have to be considerably increased. To ensure maintenance of standards, however, this expansion should be related to available personnel and facilities and no institution should be allowed to undertake postgraduate instruction unless it has adequate, integrated facilities for education and research.

(4) Central Research Institutes like the Indian Agricultural Research Institute (IARI) and the Indian Veterinary Research Institute (IVRI) and the National Dairy Research Institute (NDRI) and the agricultural universities would constitute suitable centres for strong postgraduate schools in agriculture. Close coordination among these institutions on the one hand and with ICAR on the other should be established.

(5) Admission to postgraduate courses should not be restricted to agricultural graduates only. Talent from as many fields as possible should be harnessed to the betterment of agricultural research and education.

(6) To enable the students to undertake independent study and to ensure their introduction to research as early as possible, each university should have a well-equipped library with adequate staff.

(7) Coordinated, problem-and-production-oriented research projects recently evolved by the ICAR should be developed further.

(8) Duration of first degree course should ordinarily be five years, after ten years' schooling.

(9) *Teachers.* For as many of the staff members as possible, there should be integrated assignments between classroom teaching and laboratory

research, experimental research and work in the field with rural people.

(10) The UGC scales of pay should be extended to agricultural universities also. Other conditions of service should be made attractive.

(11) The strength of any faculty should be determined by needs and quality of staff and not by any rigid hierarchy. Merit should be the main consideration for promotion within a faculty.

(12) The faculties should have reasonable academic freedom.

(13) External examinations should be reduced in importance and abolished as early as possible.

(14) A large-scale programme of teacher training should be undertaken immediately in 5 or 6 existing high quality centres, offering attractive scholarships to graduates in science and agriculture.

(15) *Students.* Scholarships awarded should cover not less than 25 per cent of the students in agricultural universities.

(16) To attract talented students the present scales of pay offered to agricultural graduates should be improved.

(17) *Farm.* Well-managed farms, about 1,000 acres in size and with not less than 500 acres of cultivated area, should be attached to every agricultural university.

(18) *Internship.* Possibilities of providing one year internship on a well-managed State university demonstration farm before awarding the degree to the students should be explored.

(19) *Number, Size and Organization.* In the process of establishing one agricultural university in each State, the possibilities of converting existing universities into agricultural universities should also be studied.

(20) While some experimentation should be allowed, it is essential that all agricultural universities should conform to some important principles such as, being single campus universities without any affiliated colleges. If for any exceptional reasons, the university should take over the responsibility for colleges outside its campus, they should be made constituent colleges under a unified administration. 14.07-34

3 Contribution of other Universities for the Development of Agriculture.

(1) Other universities wishing to introduce agricultural studies should be given all assistance.

(2) An academic relationship between some of the agricultural universities and the IITs should be developed. This can take the form, among other things, of an exchange of students and staff, and arranging common programmes of study and research.

(3) The possibility of organizing agricultural faculties in one or two of the IITs and in some leading universities should be explored. 14.35

4 *Agricultural Colleges.* (1) New agricultural colleges should not be established and the training of undergraduates and postgraduates in agriculture should be done in agricultural universities.

(2) Where agricultural colleges are constituent colleges of a university, it should be assisted to develop strong agricultural faculties.

(3) Every agricultural college should have a well-managed farm of at least 200 acres.

(4) Quinquennial inspections of agricultural colleges jointly by ICAR and UGC should be undertaken, and such colleges as do not come up to the requisite standards should be disaffiliated. Some of the colleges may be converted to offer courses at a higher technician level instead of a degree. 14.36-37

5 *Agricultural Polytechnics.* (1) Agricultural polytechnics at post-matriculation level should be organized on a priority basis. These should be attached to agricultural universities and be large institutions with enrolments around 1,000 students. To meet immediate needs, courses may also be added to existing polytechnics located in predominantly rural surroundings.

(2) The polytechnics should be multipurpose institutions providing training for imparting the wide range of skills needed in agriculture and allied fields. While reasonable flexibility should be allowed in their organization, these courses should be distinctly practical in nature. Courses offered should be predominantly terminal in character leading to specific employment, with adequate provision for the exceptionally brilliant students to take up courses in higher education through further study. In course of time, the polytechnics should offer short condensed courses, particularly for the young farmers and also of special interest to girls and women in rural areas.

(3) Attractive scales of pay and adequate qualifications should be prescribed for the staff of these polytechnics. 14.38-43

6 *Agricultural Education in Schools.* (1) Attempts to train for vocational competence in farming through formal schooling in agriculture at primary and lower secondary levels have failed and further efforts should be held in abeyance.

(2) Instead of any narrow vocational training, the school should impart a sound general education with particular emphasis on mathematics and science, as the best preparation for coping with the inevitable rapid changes characterizing our future agriculture.

(3) The proposal for setting up a large number of junior agricultural schools is beset with several difficulties and may fail to serve its objectives. It should be abandoned. 14.44-49

7 Agricultural Education as Part of General Education. (1) In all primary schools including those in urban areas, some orientation to agriculture should form an integral part of general education.

(2) Agriculture should also be made an important part of the work-experience at the school stage.

(3) Undergraduate and postgraduate courses in the colleges and universities should give prominence to orientation to rural and agricultural problems. UGC and other authorities should take suitable steps in this regard.

(4) Similar orientation in agriculture and rural problems should be introduced in all teacher training programmes. 14.50-51

8 Extension Programmes. (1) In raising the professional and technical competence of the VLWs and of the specialists who support them, the agricultural university and polytechnics should render all necessary assistance by making available the specialist staff and by organizing special courses.

(2) When the proposed separation of supply services from the extension work takes place, the extension part of it should be transferred to the agricultural university maintaining, at the same time, closest liaison between the extension work, supply and other programme services of the department of agriculture.

(3) The target should be to set up at least one primary extension centre in every community development block for purposes of extension work, within cycling distance of the area served. It is essential that these centres are manned by staff with a practical knowledge superior to that of the farmers whom they are educating and also that they receive the strongest support and guidance from the extension services of the agricultural university.

(4) Greater use should be made of successful farmers in the carrying out of extension work in education about agriculture generally.

(5) The individual village farmers attending courses at primary extension centres should be encouraged to start Farmers' Study Circles in their villages.

(6) Fullest use should also be made of radio, films and other audio-visual aids in educating farmers and the rural community. 14.52-67

9 Manpower Needs. Steps should be taken for preparing more accurate estimates of the requirements of manpower in the agricultural development. In the meantime, vigorous efforts should be made at least to double the output of graduates and to produce an equal number of diploma holders, in the next ten years. 14.68-69

10 *The Role of the ICAR and UGC.* (1) Responsibility for ensuring that agricultural education is launched on the basis of an integrated approach to teaching, research and extension can best be carried out by ICAR.

(2) To enable the ICAR to fulfil its responsibility in this regard, a special Standing Committee of the Council should be set up with a scholar or scientist of national repute at its head.

(3) There should be some overlap in the membership of the UGC and the above Standing Committee and they should evolve common programmes for the development of higher education in agriculture.

14.70-71

CHAPTER XV

VOCATIONAL, TECHNICAL AND ENGINEERING EDUCATION

15.01 Success in industrialization depends to a large extent on an adequate supply of skilled manpower. The Government of India has already emphasized this.

The wealth and prosperity of a nation depends on the effective utilization of its human and material resources through industrialization. The use of human material for industrialization demands its education in science and training in technical skills. Industry opens up possibilities of greater fulfilment for the individual. India's enormous resources of manpower can only become an asset in the modern world, when trained and educated.¹⁷³

It is the task of the planner and the educator to foresee the needs of industry and to provide the appropriate training programmes on an adequate scale and at the required levels of quality.

15.02 In the course of the chapter we shall examine some important problems of education for industry, *viz.*, the educational and training facilities at the school level for the supply of skilled workers and technicians; higher education for the supply of engineers; manpower needs; medium of education; cooperation with industry; correspondence education; and the administration of technical and engineering education.

15.03 *Developments in the Post-Independence Period.* The development of technical education has been one of the major achievements of the post-Independence period. The creation of the All-India Council for Technical Education in 1945 and the Report of the Scientific Manpower Committee in 1947 had a far-reaching influence on this development. A further impetus was given by the Engineering Personnel Committee (1956) and the Committee for Postgraduate Engineering Education and Research (1961). The development of technical education as it relates to industry was promoted through the Apprenticeship Act (1961), the Industrial Training Institutes (ITIs) and junior technical schools at the skilled worker level and the spread of polytechnics at the technician level. Another significant factor that helped this development was the assistance received from friendly countries and international

¹⁷³ Science Policy Resolution, Government of India, 4th March, 1958.

organizations in the form of scientific and technical equipment, services of expert professors in various branches of technology and facilities given abroad for the training of teachers. The first foreign aid for this was received from UNESCO in 1951 followed by the USA, the USSR, West Germany, Colombo Plan, etc. All higher institutes of technology are receiving the benefit of such assistance. This system now provides a good basis on which to build and the tasks ahead are to determine the directions in which expansion is needed, to make full use of existing facilities, and to improve the quality of training.

15.04 Despite repeated exhortation, it is unfortunately still widely felt that vocational education at the school level is an inferior form of education, fit only for those who fail in general education, and the last choice of parents and students. A concerted effort is needed by both Government and industry, through enlightened wage policies, vocational guidance and the education of public opinion, to promote the status and value of the skilled craftsman and technician.

15.05 Too sharp a distinction, however, must not be drawn between general and technical education. General school education should introduce children to the world of work and to an understanding of science and technology. Technology itself is evolving so rapidly that a student who receives only a narrow and specialized training, to the exclusion of general education in the sciences and humanities, will quickly find his skills obsolescent and lacking an adequate base for rapid re-training and ill-fitted for the complexity of the demands of the modern world. Therefore, while all general education should contain some technical education of a pre-vocational nature, all technical education should also contain an appropriate element of general education.

15.06 In our view, the education system is not organized to provide to industry a product immediately ready to assume full occupational responsibility. Formal training, even at the highest level, must always be completed by a period of practical training and internship within industry itself. A sound system of technical education results from a partnership between industry and the educational authorities. The training given within educational institutions must be linked directly with production, should be oriented to problem-solving and directed towards constantly improving instructional methods through professional contacts. Industry must accept to play its full role in the preparation of those who will later man its services by providing courses, cooperating in sandwich training schemes, making available facilities and staff for part-time teaching, assisting in the drawing up of courses of study, and making technical careers attractive. Technical education can be either institution-based with training completed within industry,

or industry-based with part-time education or re-training being provided by institutions.

15.07 One further preliminary remark needs to be made. Education and training for an industrial career does not terminate with the attainment of a certificate, diploma or degree but extends throughout that career. Periodic re-education and re-training to meet an ever-changing technology are becoming increasingly important.

VOCATIONAL AND TECHNICAL EDUCATION AT THE SCHOOL LEVEL

15.08 It is generally agreed that technical training for industry is concerned with the following levels of skills:

- semi-skilled and skilled workers (including first-line supervisors);
- technicians (diploma holders)—both supervisory and higher-technician or technologist;
- engineers (graduates);
- research and design engineers (postgraduates).

Facilities at the lower secondary and higher secondary levels are concerned with the education and training of the first two groups. We shall discuss these in some detail in this section before passing on to the discussion of the education of engineers at the undergraduate and postgraduate levels.

15.09 *Main Proposals on the Subject Discussed Earlier.* To begin with, we may briefly recall our broad proposals on this subject which have been discussed in the earlier chapters. Our main recommendation is that, by 1986, some 20 per cent of all enrolments at the lower secondary level and some 50 per cent beyond class X should be in part-time or full-time vocational and professional courses.¹⁷⁴ A strong effort, primarily by the Central Government, is needed to encourage boys and girls particularly in the age-group 14–18 to follow vocational and technical courses. A concerted and sustained programme by all Ministries and Departments is needed to interest parents and children in technical work, in vocational courses, in making technical careers attractive and in informing public opinion of needs and possibilities. A Centrally sponsored scheme of assistance to vocational courses, along the lines of the Smith-Hughes Act of the USA, under which direct subsidies are made from federal funds, could give an effective impetus to this programme. Schools themselves should be outward-looking to the world of work and organize effective guidance programmes¹⁷⁵

¹⁷⁴ See also Vol. II, Chapter VII.

¹⁷⁵ See Vol. II, Chapter IX.

which can be assisted by vocational guidance committees at the district and State levels. These should be made up of representatives of interested departments, employers—particularly industry—and teachers. They should develop guidance and career information material for headmasters, teachers and parents, organize courses on vocational guidance and provide career counsellors to act as a link between the schools and employers.

15.10 At this point we would like to make clear what we intend by diversion into vocational education at the school stage. It is fundamental, in our view, that such courses at this stage be predominantly terminal in character. There should always be opportunities for the exceptionally gifted child, through further study, to rejoin the mainstream and move higher. But vocational courses should not be designed with the exceptional child in mind. Bridges can be built for him, but for the great majority these courses should be terminal, qualifying for direct entry into employment and it should be clear to the parent, child, educator and employer what type of employment the trainee will qualify for. We believe that failure to observe this principle has, in some instances, led to a confused situation in training facilities offered at this stage.

15.11 Children following the stream of general education will increasingly be introduced to the world of work through the proposed programme of work-experience and applied science given in Chapter VIII. (Vol. II). Technical education proper can contribute to the success of this by training the instructors needed and by manufacturing in its workshops some of the tools and equipment required.

15.12 *Training of Semi-skilled and Skilled Workers.* Semi-skilled and skilled workers are now trained principally in the ITI's of which some 356 exist with a total capacity of 1,13,000. In addition, facilities exist in technical high schools principally in the area of the old Bombay State, in junior technical schools (there are 103 junior technical schools with a total potential capacity of 18,000), in artisan training centres (under the Ministry of Community Development), in the programmes of the Khadi and Village Industries Commission, in a number of private and government trade schools, and in the technical, commercial and agricultural streams of the multipurpose schools designed to give a vocational bias to the students in preparation for their training as skilled workers. Outside this institutionalized training, a proportion of the present labour force is also trained either on-the-job or through the traditional type of father-to-son training. This, in its organized form, is controlled under the Apprenticeship Act in some 1,834 establishments with more than 22,000 places.

15.13 The Fourth Plan proposals include a programme for the

doubling of the annual output capacity of the ITI's. The Ministry of Labour and Employment, through its various committees, has recently revised the syllabuses of the different courses of the ITI's and the nature of the training to be offered. This has been done to meet, among other things, criticisms that there was over-production of trainees in certain skills, that the type of training offered was not sufficiently practical in character and a closer cooperation between training programmes and industry was needed. It has, in addition, been suggested that the courses of study should be re-designed not only in the light of more detailed job specifications but also to include a greater amount of general education and to give the trainees a broader base of skills. Matriculation is a pre-requisite for training in twelve of the trades offered and middle-school pass for the remaining thirtynine.¹⁷⁶ The minimum age of entry has been lowered to 15 with effect from 1966.

15.14 It is worth noting that even for courses where only a middle-pass is required a large percentage of applicants are in fact matriculates and, in the competition for places, naturally stand a better chance. This militates against a larger diversion of pupils into vocational education after full primary education. We recommend that the possibility of a still further expansion of facilities in ITIs should be explored and if possible the available places should be more than doubled in the Fourth Plan. Particular efforts should be made to attract boys after the primary school. In time we would hope that the minimum age of entry could be lowered to 14, with suitable adjustments in courses, so that there is not the present gap between completion of primary education and entry into ITIs.

15.15 The other main form of full-time technical education for skilled workers is the junior technical school and the longer established technical high school. Both accept children after the primary stage and normally offer a three or four-year course of training which combines general education and technical training including workshop practice. The success of these institutions has varied considerably. Technical high schools are reported to be popular in Maharashtra and Gujarat and the junior technical schools in some parts of Madhya Pradesh, Madras and West Bengal. However, a study¹⁷⁷ recently conducted by the Planning Commission shows a high wastage rate in a number of junior technical schools and the fact that a significant percentage of those passing out do not enter employment but rejoin the educational stream, either in polytechnics or PUC courses. We have ourselves observed instances of a confusion of aims in certain institutions and an attempt in some to offer a diluted form of diploma training. The trainees

¹⁷⁶ These totals include both engineering and non-engineering courses.

¹⁷⁷ See *Factual Survey of Junior Technical Schools*, Planning Commission, New Delhi, 1964.

of these institutions are also at a disadvantage in comparison with those coming out of the ITIs since on the ground of insufficient workshop practice they are not given equivalent exemption for entry into further training under the Apprenticeship Act.

15.16 We recommend that the junior technical schools be renamed technical high schools (the word 'junior' serving no purpose) and along with the existing technical high schools be unmistakably designed as schools for the training of skilled workers and as such made attractive to students and employers and not be regarded as a poor alternative to general secondary education or as a more costly preparation for entry to polytechnics. The courses offered should be clearly terminal and adjusted through the greater use of available time to meet the requirements of the Apprenticeship Act (the regulations of which should be amended to accept those qualifying from these schools) and lead to trade certificates. The length of courses need not be a standardized three years but may vary from course to course with a strong emphasis on experimental work and applied sciences in all these schools. A number of these institutions should be selected for development as quality institutions, within the framework of the proposals made in Chapter X (Vol. II).¹⁷⁸ Re-designed along the lines we have recommended and with a reduction in present wastage rates, technical high schools, with their greater emphasis on general education, could be a valuable alternative to ITIs in preparing skilled workers, and to general secondary schools.

15.17 Both ITIs and technical high schools must offer production-oriented training and should be encouraged to accept some production work from industry and to manufacture material for use in other educational institutions. Their workshop exercises should be revised, revitalized and modernized.

15.18 In addition to these two forms of institutional training, we recommend that skilled workers' training courses, with entry requirements below class X, be also attached to polytechnics. This would permit the use of existing facilities and staff and provide, in some areas, a further alternative form of training.

15.19 *Technician Training.* The second level of skills which the education system at the secondary level is called upon to provide is the middle-level supervisory and technician group. The technician or middle-level specialist is the one whose role is least understood in India and, as will be shown later, is the one whose numbers we believe

¹⁷⁸ Technical high schools in Maharashtra and Gujarat may continue to experiment with a general technical course as well, as an alternative preparation for higher studies, and these experiments should be carefully evaluated in time.

should be immediately increased. We reproduce (as an example) a definition of his function by the Engineering Societies of Western Europe and the United States:

An engineering technician is one who can apply in a responsible manner proven techniques which are commonly understood by those who are experts in a branch of engineering or those techniques specially prescribed by professional engineers.

Under general professional engineering direction, or following established engineering techniques, he is capable of carrying out duties which may be found among the list of examples set below.

In carrying out many of his duties, competent supervision of the work of skilled craftsmen will be necessary. The techniques employed demand acquired experience and knowledge of a particular branch of engineering combined with the ability to work out the details of a task in the light of well-established practice.

An engineering technician requires an education and training sufficient to enable him to understand the reasons for and purposes of the operation for which he is responsible.

The following duties are typical of those carried by engineering technicians:

Working on design and development of engineering plant and structure; erecting drawing; estimating; inspecting and testing engineering construction and equipment; use of surveying instruments, operating, maintaining, repairing engineering services and locating defects therein; activities connected with research development, testing of materials and components; soil engineering; servicing equipment and advising consumers.

Within this broad category, there are several levels of skills required ranging from the first-line supervisor or foreman of a group of workers, who may be promoted from among skilled workers and given training (as is done by the Directorate-General of Employment and Training) through the technician who may replace the engineer for well-proven assignment, to a higher technician, or a sort of technologist, qualified to replace the engineer for some design, inspection, testing and erection jobs. Technicians are, in the main, trained in three-year diploma courses in polytechnics, of which there are some 274 (plus 17 girls' polytechnics) as against 43 in 1947.

15.20 In India, many graduate engineers are in fact doing what should be regarded as technician type work.¹⁷⁹ This is a wasteful use of their skills and an unnecessary charge on training costs. Highly industrialized countries are placing more and more emphasis on the

¹⁷⁹ See, for example, the IAMR Study, *Co-ordination of Engineering Education with Employment of Engineering Manpower*.

training of middle-level technicians, whose role and status are, unfortunately, little appreciated in India. Evidence presented to us of overseas practices as well as the figures of educational attainment of those now in employment in India, tends to show that our pyramid of trained manpower is top heavy. While proportions vary from industry to industry, the ratio adopted in advanced industrialized countries appears to be of the order of 1 : 3 or 4 or even 1 : 5 or 6 (a ratio recommended by the 1956 UK White Paper on Technical Education). In India, the aggregate ratio is today 1 engineer to about 1.4 technicians. This ratio varies from industry to industry and includes certificate as well as diploma holders. The Fourth Plan proposals, as tentatively drawn up, would see an increase in this ratio to about 1 : 1.5. While overall ratios in this respect may be misleading in their application to each of the courses available to polytechnics, there seems to us to be a strong case for a much more rapid increase in facilities at the technician level.¹⁸⁰ We therefore strongly recommend that public and private industry take immediate steps to make the careers of technicians attractive in their status and salary conditions and cooperate with educational authorities in expanding and improving training facilities at this level. Our immediate goal should be to improve the overall ratio of engineers to technicians to 1 : 2.5 by 1975 and 1 : 3 or 4 by 1986.

15.21 For its part, the education system must make vigorous efforts to correct defects in the present training. Three criticisms are frequently heard from both industrialists and educators. One is that the courses offered by polytechnics tend to be diluted forms of engineering courses. A second is that the training is insufficiently practical or industry-oriented. A third criticism relates to the amount of wastage in students enrolling for courses. Various studies on this last point have, for different periods, shown overall range of wastage rates in diploma courses varying between 35.6 per cent and 50 per cent.

15.22 Immediate steps are needed to correct these weaknesses. In the first place, periodic investigations should be carried out in cooperation with industry, aimed at job analysis and specifications in terms of levels and clusters of skills and responsibilities for technicians. Courses should be revised in the light of these determinations, aiming not at producing a lower class engineer, but a technician in the terms we have defined. Since industry must be expected to complete, through experience and specialization, the training of technicians, as of other specialized workers, there is no need to design highly refined courses based on detailed job-by-job analysis. Groups of related skills only need be identified to begin with in certain areas of industry—civil, electrical, chemical, textiles, mechanical and mining.

¹⁸⁰ The same argument holds good for the ratios between skilled workers and technicians.

15.23 A second immediate reform should aim at making diploma training more practical, by including industrial experience, particularly in the last year of training. Such practical experience should be of a project, problem-oriented type and will of necessity have to be within a speciality being practised by industry in the locality of the polytechnic. The aim would not be so much to turn out a diploma holder who has specialized in bridge building or road construction, for example, but to give practical experience in the application of the principles and processes studied during the course.

15.24 There are at least two important consequences of this. The first is that polytechnics should be located only in industrial areas, industrial estates or areas specifically designated for development as industrial locations. The location of polytechnics should not be determined on an arbitrary rule of one per district, but should be guided by the location of industries and employment potentials. A number of polytechnics are in rural areas where no industry exists for the moment or is likely to exist. In our view, these polytechnics should develop courses allied to agriculture for the craftsmen and technicians needed by agro-industries and extension work.¹⁸¹

15.25 The second important consequence of this recommendation is that the teachers in polytechnics should not be fresh degree holders from engineering colleges, but should combine good practical experience with academic qualifications. A greater effort should be made to recruit teachers, including diploma holders, from industry. Academic requirements should be relaxed to ensure this and salaries should not be linked to academic qualifications only. Extensive programme of summer institutes should be organized for the staff of polytechnics including those recently appointed. In addition to the training colleges for polytechnic teachers, courses for them should also be organized at the regional colleges of engineering and institutes of technology where the trainees should be given orientation in teaching practice as well as supervised production experience and courses in the basic sciences.

15.26 It goes without saying that every polytechnic should have well-equipped workshops and laboratories and use them fully. But to give training in as near realistic conditions as possible, we recommend that vacations be used by students and staff to do production work on hand tools, simple machine tools, small lathes, drilling machines, etc., either for equipping secondary schools or for sale. In larger towns this production work should, as far as possible, be carried out in cooperation with industry.

15.27 Due to the present relatively poor standards in science and mathematics teaching in lower secondary schools, the teaching of these

¹⁸¹ See Chapter XIV.

subjects in polytechnics needs to be strengthened, particularly in the first two years. The long-term solution, of course, lies in better science teaching in the schools. But until this happens the polytechnics will have to take corrective measures. Since technicians will be called upon to assume semi-managerial roles, their training should also include some introduction to industrial psychology, management, costing and estimation.

15.28 As pointed out earlier, a substantial number of technicians will continue to come up, and should be encouraged to do so, through industry. Polytechnics can assist in this by offering part-time courses, though greater success would probably follow the wider institution of sandwich type courses, designed in cooperation with industry. These could, for example, be based on six months in the institution and six months' industrial training. These would provide a good balance of theory and practice, permit the training of two batches per year, the uninterrupted utilization of students in industries for a significant period, and allow students, during their period in the institutions, to take full advantage of student life and college facilities. The periods within industry and in the institution could, however, vary with circumstances.

15.29 This new type of training suggested will require a much closer cooperation with industry than has been the case so far, partly in order to ensure appropriate practical experiences for students, partly to strengthen the teaching of staff within the polytechnics, and finally in order to design courses of study more closely related to industrial needs. We find that there is not a great mobility of diploma holders within India and that even when opportunities for employment are lacking on the local market, technicians are reluctant to migrate elsewhere. In our view, therefore, the courses offered in polytechnics, at least during the Fourth and Fifth Plans, can be designed largely with local requirements in mind, though a watchful eye on total national needs should be kept. It follows from this that in designing the courses of study offered a large degree of latitude should be allowed to the principal of each polytechnic. In arriving at decisions on this, he should look closely at local manpower needs and evolve some forecasts for his region in cooperation with industry and the State manpower officer.

15.30 Particular attention should be given to developing courses of special interest to girls in all polytechnics. While a majority of courses will appeal to both boys and girls, there are careers in commerce, the service trades and industry of special interest to girls. Examples are: courses in secretarial practice, pharmacy, interior decoration, electronics and radio technology, instrument technology, dress design, commercial art, medical laboratory technology, library science and architecture.

Courses in these areas are already being offered in the seventeen polytechnics for girls, but all polytechnics should be assisted to offer such courses, at both the certificate and diploma levels, and to attract into them girls who have completed the lower secondary course. For some time it may also be necessary to open more polytechnics for girls in order to attract them into these courses. The principals of polytechnics should work with the guidance services and the heads of high schools in attracting girls to these careers.

15.31 In implementing the above programmes for expanded and reoriented technician training, the greatest attention should be paid to ensuring the fullest use of facilities. Present wastage rates are around 40 per cent. Every effort must be made to reduce this to a minimum and to expand existing polytechnics to their optimum size. One of the main contributing factors to high wastage and low utilization is inadequate staffing. In 1965, about 31 per cent of sanctioned posts were 'unfilled'.¹⁸² In addition, there is a frequent turnover of staff. Poor remuneration is most frequently quoted as the reason. This undoubtedly contributes and we recommend that immediate steps should be taken to ensure the implementation of the revised scales of pay and service conditions. This scale should overlap with that of the staff in engineering colleges but, as stated earlier, should not be tied solely to academic qualifications. This would be in keeping with our plea for enhanced status for the technician in industry and society. We believe that lack of job satisfaction also contributes to the loss of teachers and the poor response to recruitment. The production programmes for polytechnics suggested earlier, which will give the staff an opportunity to design, supervise and participate in production would, we feel, help in changing this attitude as well as in providing an additional remuneration and incentive.

15.32 As pointed out earlier, the level of responsibilities of technicians is a graded one, and at the top, in certain specific and established jobs of testing, design, installation, assistance in research and development, and supervision of manufacture, the technician may replace the engineer at a responsible level. In some countries, the category of higher technician, technician-engineer or technologist has been established to fill these roles and specific training programmes and certification provided. This is an important concept, and the numbers of these will grow in India with the further sophistication and expansion of industry. We recommend that selected polytechnics provide post-diploma courses for technicians with some years of experience in industry for the training of such higher level technicians, where the periodic surveys of job specifications recommended above, show this to be desirable, or where principals of polytechnics and industry identify the need.

¹⁸² For details, see Table 15.2.

15.33 *Other Vocational Education.* We have recommended a far greater diversification of courses at the higher secondary (classes XI and XII)₁ level. It is at this level, alongside the polytechnics, that the greatest effort can be made to vocationalize and specialize our educational system. A great range of courses in commercial, scientific and industrial trades can be offered. Terminal courses leading to certificates and diplomas in these areas, and in areas of special interest to girls such as domestic science, nutrition, nursing, social work, etc., can be of one, two, three or four years' duration and be offered in schools or special institutes (e.g., for seamen, extension workers, nurses, distributive trades, commercial art and design, etc.). Provided proper standards of curriculum, teaching staff, equipment, location and certification are maintained, the greatest latitude for local initiative and experimentation can be encouraged. Arrangements with employers for sandwich courses or for the part-time release of employees (say 2 or 3 days per week) for training purposes should be worked out and evening, correspondence and vacation courses should be offered for those who enter employment after class VII or X.¹⁸³

15.34 *Education for Self-employment and Small-Scale Industry.* The dimensions of the problems arising from the growth of the organized employment market, particularly in relation to the growth of stocks of educated people, have been discussed elsewhere.¹⁸⁴ We wish to stress here only one point: the responsibility of technical and vocational education for training not only those who will seek employment, but also those who will create employment. This, we feel, has particular relevance at the skilled worker and technician level. With electrification, irrigation, communications, and other facilities reaching villages, new opportunities for skilled craftsmen will arise, either for repair work or for small-scale production. Products of technical high schools, polytechnics and the agricultural polytechnics proposed in the preceding chapter, should be encouraged to think of setting up small enterprises of their own or joining together with others in creating small-scale workshops, industries or services needed in the community, on a self-employed, co-operative or community-sponsored basis. Such enterprise is encouraged under the Small Scale Industries Scheme and educational authorities have a responsibility to interest their students in these possibilities.

15.35 *Part-time Education.* Facilities for part-time, on-the-job and vocational and technical training for those who have entered employment or are seeking employment after leaving school below class X, need also to be greatly expanded. These may be offered on a part-time, apprenticeship, day-release, correspondence course, sandwich course, or

¹⁸³ For suggestions on courses, see Annexure to this chapter.

¹⁸⁴ Vol. I, Chapter V.

short-intensive course basis and will vary in duration from six months to four years. The same principle should be applied with greater force at the post-class X level. It may be pointed out that courses of this kind offered in Further Education in the UK total more than 200.¹⁸⁵ The numbers now enrolled in apprenticeship courses in India need also to be greatly expanded.

15.36 The agencies to be involved in the creation of such programmes would be Government (including the Armed Forces), industry, educational institutions, and professional organizations. The courses should be designed to prepare semi-skilled and skilled workers as well as supervisory personnel who are unable to join polytechnics on a full-time basis. One important consideration should be to avoid a rigidity of approach and allow local authority to design courses which, in content and duration, suit the needs of local industry and employment possibilities. Experimentation should be encouraged and the cooperation of industry will be essential. Of importance in this regard, in our view, would be the appointment of training officers in large industrial undertakings to ensure that courses of study are well designed and efficiently carried out in cooperation with educational institutions and authorities. The amount of general education to be included in these courses would vary according to the discipline and the level of educational attainment of the students enrolled.

THE EDUCATION OF ENGINEERS

15.37 *General Observations.* Though we confine our attention to the institutional preparation of future engineers, we recognize that there is a considerable number of practising engineers in India who, for many good reasons, have not taken degrees but have risen by merit and experience through industry's ranks. Many of these are holding responsible positions and discharging their duties with high competence. Since progress in industrialization will depend more and more on a deep understanding of the basic sciences, the training of engineers necessarily becomes more and more institution-based. This is as it should be. But it should also be recognized that 'practicals' have always contributed greatly to industrialization, particularly in its early stages. Since outstanding potential engineers and technicians should always have an opportunity to improve their qualifications, widespread and professionally supervised facilities for part-time, correspondence, and vacation courses should be organized for those who wish to further their training.

¹⁸⁵ For a list of suggested courses, see Annexure to this chapter.

15.38 Institutional facilities for the education of engineers have greatly increased since 1947. As against 45 colleges in 1947, there were 133 in 1964. Expansion has created difficult problems with regard to maintenance of quality, and rapid technological advances make an examination of the education of engineers more urgent each year. We shall discuss this problem under some important aspects such as the duration of courses, content, teachers, wastage, costs, equipment, postgraduate courses and manpower needs.

15.39 *Duration.* Considerable variation exists in the duration of courses and admission requirements as shown in Table 15.1.

TABLE 15.1 DURATION OF ENGINEERING COURSES FOR THE FIRST DEGREE (1965-66)

No. of institutions	Duration of courses	Minimum admission qualifications
90	5 years	Higher Secondary or equivalent
31	4 years	I.Sc.
7	3 years	B.Sc.
4	3 years	I.Sc.*

* A few institutions in Maharashtra and Gujarat offer these courses.

15.40 We believe that ordinarily for an engineering degree a minimum of five years of engineering education after completion of the present higher secondary stage (eleven years' schooling) or its equivalent, is essential. This includes the time spent to acquire 'production experience' in industry. This may be reduced to four years after the intermediate or its equivalent. But we do not at all favour courses of three years' duration after I.Sc. because it hardly seems possible, except with enormous strain on the students, to attain the required standards therein. We understand that the AICTE has proposed replacement of these by other types of courses. As a general recommendation, we urge that all institutions not conforming to the prescribed standards should be improved, or converted to institutions training technicians, or closed.

15.41 The recruitment of well-qualified B.Sc. students in engineering courses specially in subjects such as electronics, instrumentation, should be strongly supported and encouraged, with courses suitably adjusted to make up for their inexperience in workshop practice. Such courses should be normally of three years' duration. The possibility of some of

the colleges providing only post-B.Sc. engineering courses should be explored.

15.42 *Content.* There are two general observations to be made. The first is the need to strengthen the teaching of the basic sciences specially for those of our engineers who are to be concerned with research and development and participate in and even anticipate technological advances. Ways should be found for encouraging students whose gifts are for research. We find that, in many engineering institutions, science departments are treated as Cinderellas and the scales of pay of science teachers are considerably below those of their colleagues in the engineering departments. We recommend that steps be taken to remove these anomalies. The scales should be the same in science and technology faculties. Furthermore, we recommend that an appropriate number of posts (say, one-fourth or even one-third of the total strength of the department) be reserved in engineering departments, for persons with suitable qualifications in basic science subjects and an equivalent number of posts for engineering be reserved in science departments. The engineering universities should take the initiative in these matters and help should be given by the UGC. Extensive use of science (mathematics, physics, etc.) should also be made in teaching of engineering subjects. The recruitment of B.Sc. students into engineering courses at appropriate points will also help in this direction.

15.43 Here again, it is the general view—particularly of employers—that our graduates lack practical experience and knowledge of industry. The existing practice of requiring practical experience in vacation periods is open to a number of abuses. Students do not take such training seriously, are too immature in their first years to profit from it, are insufficiently supervised, and are rarely guided into a problem-solving, project-oriented way of thinking. A number of steps can be suggested to correct these defects. Practical experience for full-time students can be delayed until the third year of the course, properly prepared in cooperation with industry and properly supervised and completed before the end of the course. While we believe that a strong science base is needed by engineers, we believe, if anything, even more strongly (and this is particularly important in the context of our present needs) that production experience should be an integral part of the curriculum. We recommend the wide extension at this level, as with technicians, of sandwich type courses. A beginning in this direction should be made as early as possible, and institutions which, because of their location or other reasons, are in a favourable position to organize these courses should be given every encouragement to do so. Besides ensuring a stronger link with industry and giving a more practicable bias to train-

ing, such a practice will have other advantages. It will shorten the period before which an engineer is productive; it will permit students to earn while they learn; it will draw industry and institutions closer together; and it would permit some students in non-industrial areas to follow technical courses.

15.44 Several steps can also be taken within the institutions. Workshop practices can be made more production-oriented, both in the prescribed courses and in vacation periods, with staff and students undertaking research and design of equipment needed in other educational institutions. Groups of students can be set production problems, taken from industry, as project work. Teachers and university departments should be encouraged to undertake consultancy for industry and should themselves work in industry in vacation periods. Frequent professional contacts in summer institutes between teachers and industry should be organized. Graduates should be required to have at least one year's practical experience in industry before proceeding to postgraduate work.

15.45 The requirements of industrial development in the successive five year plans make it clear that growing numbers of technical personnel will be specially required in metallurgy, chemical engineering, fuel technology, production engineering, etc., for heavy machinery manufacture, machine tools, electrical equipment, metallurgical works, fertilizers, chemical and other manufactured goods. An examination of the courses offered in the existing engineering colleges shows, however, that a majority of them provide only for the three basic fields—civil, mechanical and electrical engineering. In order to relate the courses—degree and diploma—to the varying types of engineers and technicians required by industry it is necessary to change the traditional pattern and diversify courses in the existing and new institutions to produce the needed technical personnel. The precise subject fields in which courses are to be conducted should be subject to constant review to suit the changing needs of industry for specialist technical personnel.

15.46 In addition we should like colleges and institutes of technology to become much more concerned with the future needs of industry, both in the manpower sense discussed below, and in collaborating in the form of training given. In order to make this purposeful, research design projects should be made a part of the curriculum from the third year. The aim should be to introduce students to the methodology of research. Projects could be sponsored by industry or Government and students could work in groups with assistance from postgraduate students. Public exhibitions and prizes for such research project work could be organized.

15.47 Apart from these measures to improve the present content of courses, adequate machinery for continuing revision of syllabuses is

needed. General guidance can be given at the national level by expert committees drawn from industry, teachers and research workers. Rigid conformity should not be the aim of these exercises. Universities and principals of colleges should have their own machinery, in which industry and research workers collaborate, for the determination and revision of courses, with freedom for professors and departments to develop new approaches.

15.48 One of the difficulties faced in curriculum-making is that we are telescoping, as it were, two industrial revolutions. A large part of our industry is traditional, using processes developed many years ago. Our view is that a much more significant use could be made of technicians in this area. At the same time we are entering new fields and introducing more sophisticated processes based on newer technology and applied sciences. For these new needs—many of which must be anticipated some years in advance—courses must also be developed and manpower estimates made. Some of these fields are: (1) electronics; (2) instrument technology, including automation; (3) chemical technology; (4) in metallurgy, the processing of rare materials and special alloys; (5) aeronautics and astronautics; (6) nuclear power generation. Coordination at the national level is required in the location of teaching and research facilities in these new fields. Institutions should encourage the development of extra-curricular clubs and societies among students for cultivating interest in these and the traditional fields and for carrying out additional project work.

15.49 *Teachers.* In addition to the modification in curriculum and courses of study, the quality of engineering graduates can best be influenced by the quality of their teachers. We have already suggested that teachers should themselves obtain practical experience within industry through vacation work, consultancy contracts, working with industry in the development and revision of their courses of study and carrying out research for industry. In addition, widespread summer institutes for the upgrading and constant revision of the knowledge of teachers should be organized. It should also be made possible for practising engineers to take postgraduate qualifications in sessions spread over a number of years.

15.50 The key step, however, is to make the profession attractive to good engineers. This will be partly accomplished by the conditions of work and the possibilities for research, production and collaboration with industry. While it may not be possible to compete with the best that industry can offer, many high quality engineers may prefer to work in teaching and research for significant periods in their careers. To ensure this, salary scales must be adequate.

TABLE 15.2 SHORTAGE OF TEACHERS IN TECHNICAL INSTITUTIONS

Name of State	No. of Institutions	Sanctioned strength	Teachers appointed as on 31-12-63	Vacant positions as on 31-12-63	Percentage of vacant positions
Engineering Colleges					
Andhra Pradesh	8	351	266	85	24.2
Assam	2	115	54	61	53.0
Bihar	6	602	378	224	37.2
Gujarat	5	223	135	88	39.4
Kerala	6	406	249	157	38.6
Madras	9	549	382	167	30.4
Maharashtra	8	296	210	86	29.5
Madhya Pradesh	7	459	267	192	41.8
Mysore	8	516	352	164	46.6
Orissa	2	190	90	100	52.6
Punjab	5	68	68	Nil	Nil
Rajasthan	2	188	59	129	68.6
Uttar Pradesh	3	281	124	157	55.9
West Bengal	11	552	292	260	47.1
Delhi	1	12	10	2	16.7
ALL INDIA	83	4,808	2,936	1,872	38.9
Polytechnics					
Andhra Pradesh	19	570	472	98	17.2
Assam	4	110	48	62	56.3
Bihar	11	282	167	115	40.8
Gujarat	11	413	325	88	21.3
J & K	1	15	9	6	40.0
Kerala	14	428	322	106	24.7
Madhya Pradesh	13	420	231	189	45.0
Maharashtra	21	568	395	173	30.4
Madras	25	625	446	179	28.6
Mysore	25	536	428	108	20.1
Orissa	6	144	78	66	45.8
Punjab	10	155	72	83	53.5
Rajasthan	6	114	95	19	16.7
Uttar Pradesh	30	489	289	200	40.9
West Bengal	21	572	367	205	35.8
Union Territories					
Manipur	1	13	8	5	38.5
Tripura	1	20	8	12	60.0
Pondicherry	1	40	30	10	25.0
Himachal Pradesh	1	15	13	2	13.3
ALL INDIA	221	5,529	3,803	1,726	31.2

Source. Survey of technical education carried out by Ministry of Education in December 1963.

15.51 The existing shortage of teachers in engineering colleges is disturbingly large. The above survey conducted by the Ministry of Education shows an overall shortage of 28.9 per cent in engineering colleges and of 31.2 per cent in polytechnics. To help overcome the shortage of competent teachers at the college level, a technical teachers training programme has been introduced. During the training period, young graduates receive guidance from experienced teachers, get some teaching experience, and have a reasonable possibility of obtaining the Master's degree, including practical experience. So far twelve institutions have been set up under this programme. The duration of the course is three years for graduates and one year for holders of a Master's degree, including practical experience. The intake in 1965-66 was only 122—too small for our needs. It is necessary to prepare a concrete programme for improving the supply of teachers. We recommend that the institutes of technology should undertake large-scale teacher training programmes for graduate and postgraduate students and the appropriate funds be made available for this. All such courses should include a study of a second modern 'world language', such as Russian or German, relevant to engineering and technology. In addition to these programmes, we recommend that the scheme for centres of advanced study be extended to cover the technological field and that centres in selected subjects be built up on an all-India basis and given the special responsibility of training teaching and research staff for engineering colleges.

15.52 All that has been said in the chapters on Higher Education on building up faculties and providing opportunities for the intellectual growth and professional development of teachers, applies with equal force here. The reputation of institutions will depend to a great extent on the quality of its departments and faculties. The present practice of frequent transfer of teachers and principals in government colleges for other than professional reasons must be stopped if the building up of faculties in them is to be effective.

15.53 *Equipment.* No effective training in basic sciences and engineering can be given without adequate laboratory and workshop facilities. Procedural delays are at the moment handicapping the development of these. Special consideration should be given to the timely release of foreign exchange and the stock-piling of essential equipment and spare parts, whether imported or indigenously manufactured. Purchasing should be coordinated through one agency. A more rational location of equipment and warehousing of parts and materials in terms of work flow, should be ensured in colleges. This study of location and work flow should form, in fact, part of the training of students.

15.54 Industry, and also defence, should be approached to loan or gift

new or old equipment, or the samples of their products to institutions, both colleges and polytechnics. We add here that, in our view, polytechnics should be discouraged from acquiring sophisticated equipment which is used for only a few days in the year.

15.55 While we have heard widespread complaints at both polytechnic and college levels of lack of equipment and spare parts, we have seen little evidence of attempts to design and manufacture these locally. At various points, we have suggested that workshop practice at both levels could, at least in part, be directed towards manufacture of equipment needed by educational institutions. Specimen pieces of imported items of equipment should be dismantled and prototype substitutes manufactured under the supervision of competent staff members. The design, working drawings and specifications may then be turned over to workshops for manufacture by staff and students as a part of practical training. Extra grants and rewards should be offered to encourage such initiative.

15.56 *Postgraduate Courses.* The growth of facilities at this level has been considerable since 1947. The total enrolment in 1965-66 was about 2,000 with facilities offered in about 41 institutions. Of these 41 centres, only 7 offer facilities for postgraduate diploma and Ph.D., with an intake capacity of 125. The total stock of postgraduate in engineering technology was estimated to be around 4,000 in 1964. The Ministry of Education has plans for expanding these centres and the IIT's for Master's Degree and postgraduate diploma courses in a wide range of subjects.

15.57 We have already recommended that admission requirements to postgraduate courses should include at least one year's experience within industry. Apart from this we do not see any necessity for uniformity in the duration of these courses which may vary between one or two years as required by the special field. Selected institutions should be encouraged to organize, in cooperation with national laboratories, research institutions and industry, one or two-year postgraduate courses leading to degrees/diplomas in subjects, such as industrial engineering and management, automobile engineering, fluid motion technology, rocket technology, materials science, operational research, automation, radar engineering, welding technology, highway and traffic engineering, hydrology, marine engineering, and instrument technology. The indiscriminate proliferation of postgraduate courses should be avoided, and the location of highly specialized courses, particularly those such as aeronautics requiring expensive facilities, should be determined through consultation at the national level.

Engineering research should be directed more and more towards the problems of industry, and larger numbers of those taking postgraduate

courses should be sponsored by industry, qualifying, where necessary, through sessions spread over a number of years. Apart from research, it should be permissible to obtain a doctorate degree on the basis of professional development and design work within industry. Other questions regarding research policy are discussed in Chapter XVI.

15.58 *Wastage.* We have already referred to the alarming wastage rates within the polytechnics. The wastage rates at the degree level are equally disturbing. A number of studies have been carried out into this problem since 1959 by the Planning Commission, the Institute of Applied Manpower Research and others. The latest study shows an overall average rate of wastage at the degree level of about 20 per cent, rising in certain branches and years of study to as high as 44 per cent. The causes of this situation lie partly in financial difficulties, the absence of hostel facilities, shortage of qualified staff and their rapid turnover, lack of adequate instructional facilities and difficulties with the medium of education. We have elsewhere recommended steps which, rigorously applied, should materially assist in reducing this wastage in an area of heavy investment. Further steps can be taken through the better selection of students, arresting the present practice of relaxing minimum academic requirements for admission, and the provision of remedial courses in English for students with an inadequate command over this language.

15.59-60 *Costs.* There are great variations in the total cost per student at the first degree level between different types of institutions. In IITs and even in the regional engineering colleges, the cost per student is far higher than in university colleges of engineering. The present arrangements under which the university colleges receive funds (per student) which are far lower in order of magnitude than the IITs is neither justifiable nor desirable. The standard of training in the university colleges needs to be raised and this will entail a heavier cost per student. Much larger grants to university colleges are required for their improvement. The heavy investment in IITs can be best justified only by the training of quality research engineers in crucial areas urgently required for industrial development, and the training of teachers for other colleges.

15.61 We find that engineering colleges in some of the States demand a capitation fee for the award of seats and that no action has been taken to curb such practices. We strongly recommend that such requirements for admission to engineering colleges should be stopped immediately by proper regulation of admission to all such institutions.

15.62 *Manpower Requirements and Planning.* The overall considerations regarding manpower needs within the next two decades are discussed in Chapter VI (Vol. I). The Commission had before it three esti-

mates for engineers and diploma holders. One has been produced by the Ministry of Education as the basis for calculation in relation to the Fourth Five Year Plan. A second has been developed by the Institute of Applied Manpower Research and the third by the planning unit of the Indian Statistical Institute and the Unit for Economic and Statistical Studies on Higher Education of the London School of Economics in collaboration with the Perspective Planning Division of the Planning Commission. The Commission's feeling, after reviewing these studies, is that a good beginning has been made in forecasting needs in the technical field, but that, given the variations in the estimates, the range of assumptions and the inadequacy of data, there is need for rigorous and more refined studies of the educational background of the existing labour force and for more detailed studies in each branch of industry, in terms of national, regional and State needs. This general recommendation applies for the skilled worker and technician levels as for the engineering level. When these studies are made, the opening of new training facilities and admission to courses should be linked with projected manpower requirements.

15.63 In the immediate future, we recommend that attention be given to the elimination of present wastage rates and to improvement in quality of the education offered through the different programmes we have suggested. These measures should be combined with the expansion of existing facilities to their optimum size and the development of part-time courses for those already in employment. All this should be done with the greatest care and with the fullest assurance that minimum standards will be maintained.

15.64 *Admissions.* A study carried out by the Education Commission into the socio-economic background of students admitted into vocational, technical and professional institutions in 1965 brought out certain differences between the possibilities open to different socio-economic groups. Our recommendations on the subject are given in Chapter VI (Vol. I). Though in many ways remarkable progress has been made in equalizing the opportunities open to students from rural areas or of children of parents with low incomes, there are marked variations in the composition of students in the different institutions. Thus, 87.2 per cent of students in IITs are from urban areas and only 12.8 from rural areas. The position is better in the regional engineering colleges and the Government and private engineering colleges. In engineering colleges, for example, 38.7 per cent students have parents earning less than Rs. 150 per month and only 12.6 per cent with parents earning over Rs. 500 per month. What is needed, however, is an earnest effort at a greater equalization of access to professional education. In this context, we would like

to emphasize, to begin with, an experimental approach. There is as yet no really sound method for identifying or selecting students for professional courses. It would therefore, be an advantage to provide, if possible, more than one channel or procedure of selection and to compare their validity in the light of the actual performance of the selected students in the professional colleges. The possible selection channels could be the following:

- (1) *Science Talent Research Project.* The students selected under this project should, if they desire, be entitled for admission to the IITs;
- (2) *Special Admission Tests* such as those now held by the IITs;
- (3) *Board of University Examinations.* Admitting a small percentage, say 1 per cent (or even less), to begin with, of the top students in each State on the basis of the examinations conducted by Boards of Secondary Education or universities;
- (4) *School Clusters.* A decentralized process of selecting students on the basis of school clusters as described in Chapter VI (Vol. I).

We recommend that the Ministry of Education should set up a committee to go into this matter and devise better selection procedures to institutions of professional and vocational education.

MEDIUM OF EDUCATION

15.65 At the secondary stage and at the polytechnic stage, the regional language should be the medium of education. We agree with the decision of the All India Council for Technical Education that, for the present, English should continue to be the medium in engineering education. The switch-over to Indian languages in engineering education should be linked with a similar change in science courses at the post-graduate level in the universities. English will always remain an important library language, and a good knowledge of English, as of other world languages, will continue to be required of students going in for study and research in engineering. Vigorous action, however, is required for the preparation of good textbooks on technical subjects in regional languages and for the translation of foreign books and other teaching materials. This could be undertaken in part under the scheme for the re-publication of standard works on engineering which the Ministry of Education has launched in collaboration with a number of foreign countries. University teachers and industrialists should be associated with this work. This can be begun at the national level in the production of model textbooks for translation into regional languages. The central organization should work with State and regional organizations for the selection of authors, preparation of material and publica-

tion. The books may be tried experimentally in a few selected institutions before their widespread adoption. In all regional languages, care should be taken to retain a common international terminology.

PRACTICAL TRAINING SCHEME

15.66 Before 1949, very few places were available for practical training or apprenticeship to the degree and diploma holders who had not offered sandwich courses. On the recommendations of the Scientific Manpower Committee, the Central Government formulated a scheme of Practical Training Stipends in 1949 for the graduates and diploma holders. Under this scheme, practical training places are secured in industrial concerns, technical departments of the Government and other organizations where trainees can learn in practice the application of the general principles and techniques of technology in their selected fields.

15.67 During the training period a graduate is paid a stipend of Rs. 250 p.m. and a diploma holder Rs. 150 p.m. towards their expenditure on board and lodging. About 3,000 places are at present available for fresh entrants in various establishments, and a large number of industrial concerns contribute towards a part of the expenditure of the trainees. We are aware of the usefulness of this scheme but we feel that some reorganization of the scheme is necessary. The Government should select only such industrial concerns or departments where good practical experience of value to prospective employers can be acquired by the trainees. There is also need for each of such training centres to have a superintendent in charge of the training programmes. Only candidates with high academic attainments should be selected for this training. This is all the more important as many of the teaching personnel to our technical institutions come from these trainees.

15.68 We also feel that these training facilities should be available to at least 5,000 trainees every year. We are aware that even these 5,000 places may be found to be inadequate to meet the present needs as the annual output is very much larger. Many fresh graduates and diploma holders, however, are absorbed by industry immediately after passing and given on-the-job training to meet urgent needs. A number of enterprises, particularly in the public sector, have also started their own practical training programme to give training to the personnel required. Nevertheless, we feel that the Government's training scheme serves a useful purpose as it emphasizes the need to enrich technical competence by strengthening the training with organized apprenticeship.

15.69 During the course of our deliberations it has been brought to our notice that some of the public sector undertakings which have

started their own apprenticeship schools are considering closing them down as they have already trained their required number of engineers and technicians. We suggest that the Central Government should take over such schools in the event of proposals to close them. These schools are often of high quality and have not only the physical plant and equipment for training purposes but have also developed a methodology of training with experienced staff. We should not lose such assets at this stage of our development.

COOPERATION WITH INDUSTRY

15.70 This has been a central theme of our recommendations. In some countries such as the UK, under its recent Industrial Development Act, a levy of $2\frac{1}{2}$ per cent of the wage bill is imposed on industry for providing training facilities. While re-emphasizing the need for cooperation between industry and educational authorities in the development of training facilities, we feel it may not be necessary in the early stage to enact such legislation in India. In its place industry should be encouraged to start training schemes, and a Central scheme of subsidy to industrial concerns providing training facilities may be usefully started. In public sector undertakings, a separate budget provision for this work could be made. Suitably qualified training officers should be posted to industry or groups of industries taking trainees. The training of these officers should be organized by the Ministry of Education. Representatives of industry and educational institutions should meet regularly to review training programmes.

PROFESSIONAL ASSOCIATIONS IN ENGINEERING

15.71 Professional societies like the Institution of Engineers, the Aeronautical Society, the Institution of Telecommunication Engineers, etc., are holding examinations to admit candidates to the fraternity of engineers. The Institution of Engineers started this activity as early as in 1928 to admit to its Associate Membership candidates who had not had the benefit of formal education and training but who were nevertheless fit to enter the profession by virtue of their experience and knowledge acquired through apprenticeship or service or in any other way. Such examinations are also recognized by the Government for purposes of employment in the relevant posts. About 1,000 candidates qualify at these examinations every year as full-fledged engineers and their numbers are growing year by year.

15.72 In our country where the system of apprenticeship or part-time training has not developed to any very significant extent (as against 100,000 students on full-time basis, there were only 1,000 for part-time courses in 1964), a heavy responsibility devolves on these societies to evaluate correctly the practical experience of a candidate, the extent of his theoretical knowledge and to decide whether he is fit or not to enter the profession as a qualified engineer. Adequate safeguards have to be made to ensure that standards are strictly maintained.

15.73 We have also recommended elsewhere the need to increase the number of special institutions organizing technical courses on a part-time basis. It would be useful if the professional societies are associated with such programmes and they give their associate membership to these part-timers also. These societies should even hold examinations jointly or recognize examinations held for them after assessing standards, etc.

CORRESPONDENCE COURSES

15.74 We have earlier laid stress on the need to develop part-time courses in all educational institutions on an evening, day-release or sandwich basis for those already in employment. In addition to these a greater use could be made in technical education of correspondence courses for home study. It is sometimes felt that courses by correspondence are not suitable for use in technical and vocational fields requiring laboratory and workshop practice. Many countries, however, such as Australia, the United States and the USSR use correspondence study on a wide scale for vocational and technical training. It is obvious that quite a number of vocational courses, for example, book-keeping or accountancy, require no practical workshop training though periods with a teacher in vacation times should be arranged even in these fields. For areas requiring workshop and laboratory training, institutions can be opened during the week-ends and the vacation periods for providing this to correspondence students.

15.75 The greatest attention should be paid to the preparation and testing of correspondence courses before their widespread use. In addition, the necessary administrative steps need to be taken to ensure that those following correspondence courses have access to a technical institution for guidance in their studies and for the practical experience required by the course. To launch such a scheme in India, it would probably be desirable to entrust the first experiments to selected quality institutions so that the many problems involved can be identified and their solutions worked out. The possibilities, however, in this type of

training through correspondence are so many and the capital costs involved, if proper planning is undertaken, so small that we recommend that an immediate beginning be made to develop a wide range of vocational and technical courses through this medium.

ADMINISTRATION OF VOCATIONAL, TECHNICAL AND ENGINEERING EDUCATION

15.76 At the degree level, it has long been recognized that to ensure professional growth, it is essential that those responsible for individual institutions should have the least external control and work in an atmosphere of academic freedom. In the memorandum relative to the setting up of the regional engineering colleges, it was clearly recognized that 'the colleges shall have the maximum amount of autonomy, both financial and administrative, so that their establishment and development may proceed with speed and efficiency'. Similar autonomy for the institutes of technology was recognized in the Act of 1961. The need for such autonomy and academic freedom is reinforced by our recommendations for the strengthening of cooperation between educational institutions and industry, for the development of new approaches in the courses offered and for the building up of high quality faculties. Heads of institutions should have adequate powers over both academic matters and the recruitment, retention and promotion of their staff. Government procedures should not be permitted to interfere with the development of academic excellence.

15.77 Below the degree level, a greater measure of freedom is also required for the principals of polytechnics in the execution of the programmes we have suggested and in the improvement of their relationships with industry and the development of suitable training facilities. At the craftsman level, a greater coordination is required between the different responsible departments, particularly at the State level.

15.78 At all levels, greater sensitivity to manpower needs and adequate planning machinery for the adjustment in time of both the strategic location of facilities and the intakes into different courses is required. This should go hand-in-hand with the programmes of vocational and educational guidance that we have suggested earlier.

15.79 In its Post-War Plan for Educational Development in India (1944), the Central Advisory Board of Education emphasized the need for planning technical education at the higher stages on an all-India basis for industrial growth and remarked that 'to stimulate, coordinate and control the provision of the educational facilities which such a

development as well as existing industry will need, there must be an all-India body in supreme charge'. As a result, the All India Council for Technical Education or AICTE was set up in 1945 charged with surveying the needs of the country as a whole for higher technical education, and advising in what areas technical institutions should be established, for what branches of technology each should provide and up to what standards they should operate.

15.80 Over the last 20 years the Central Government has been able to play an effective role in the development of technical education. It prepares integrated plans of development of technical education in the country for the successive five year plans, establishes higher technological institutions, institutions for specialized courses and other institutions of all-India importance, aids financially and otherwise State Governments, universities and other non-government agencies in setting up technical institutions and watches progress of technical education.

15.81 The AICTE which has the Union Minister for Education as chairman and the representatives of State Governments at Ministers' level among its members, with the Technical Division of the Ministry of Education as its secretariat, constitutes at present the administrative machinery at the Centre to deal with technical education.

15.82 The AICTE discharges its functions with the help of a Coordinating Committee, four Regional Committees and eight Boards of Studies. The Coordinating Committee acts as the executive committee of the Council and coordinates the work of the Regional Committees and Boards of Studies. The functions of the Regional Committees include surveying facilities for technical education at all stages including establishment of new institutions wherever necessary, tendering advice and guidance to institutions in the region, promoting liaison between the institutions and industry and assisting the States and institutions in securing practical training facilities. The Boards of Studies advise the Council on academic aspects. They lay down minimum standards of instructional facilities necessary for conducting various courses.

15.83 The Technical Division in the Ministry of Education with regional offices at Calcutta, Bombay, Kanpur and Madras, besides acting as the secretariat of the Council, implements the Government's policies and programmes at the same time. This duality of functions by the secretariat has no doubt helped the expansion of technical education considerably and the Council has taken a leading part in increasing the output of engineers and technicians at degree and diploma levels.

15.84 While the IITs with university status, regional engineering colleges, engineering colleges, polytechnics, technical schools and

other institutions have all been established, the main task to be accomplished now is the maintenance and upgrading of standards, constant efforts to design or redesign courses to suit the changing needs of industry, and relating enrolments to the manpower needs of the country.

15.85 The AICTE, which is an unwieldy body with the Union Minister as chairman, meets hardly once a year. Even its Coordinating Committee meets very infrequently and obviously the decisions taken tend to be more administrative than technical. The work that should normally be done by universities through their Boards of Studies is done by the Boards of Studies of the Council. While the Council performs a useful function as a high level policy formulating agency, we feel that the time has come in higher technological education to place the responsibility for stimulation and organization on the universities and institutions themselves who should have scope for experimentation and innovation. We have therefore recommended that the responsibility for the development of technical education at the university level and maintenance of standards therein should be vested in a UGC-type body to be specially set up for engineering education. This should work in cooperation with the UGC and have some overlapping membership. Coordination would still be necessary at the Centre; and a central coordinating committee consisting mainly of professionals and industrialists from public and private sectors, could continue to operate within the Ministry of Education. But the administrative work as well as the coordination of standards at the university level could be assigned to the UGC-type body.

15.86 In order to give effect to these general principles regarding the administration of technical education, we recommend the following steps:

- (1) To ensure the pursuit of the highest standards at the first degree and postgraduate levels, and to provide an adequate machinery for the national and professional concern with the future development at these levels, we have recommended in Chapter XIII the setting up of a UGC-type organization on which adequate representation should be provided for the UGC, professional organizations, industry and concerned Ministries. This body should have a full-time chairman, and funds should be allotted to it on a block basis.
- (2) This organization recommended above should work in the fullest collaboration with competent organizations such as the Planning Commission and the Institute of Applied Manpower Research, for the detailed elaboration and refinement of manpower projections of both short-term and long-term nature regarding the requirements of engineers and research workers:

- (3) The institutes of technology have already made a significant contribution to technical education, largely due to the academic freedom which they enjoy. To provide for their further development to their full potential, we recommend that these and comparable institutions be given full university status, while retaining their individual names and characteristics, and brought within the purview of the organization proposed above.
- (4) At the State level, various departments are involved in programmes of technical training at the school, polytechnic and college levels, and practices vary from State to State. In most States, technical education has been made the responsibility of a Directorate of Technical Education; and this has given a new impetus and purpose to this work. We recommend that, in all States, Directorates of Technical Education should be set up to coordinate programmes and ensure continuing contact with manpower and planning mechanisms and with the district level machinery. They should be empowered to recruit staff needed for educational institutions, thus removing a number of procedural delays which now occur through the use of State Public Service Commission channels.
- (5) Chairmen of Boards of Governors of regional engineering colleges, where constituted, should be drawn from a panel of distinguished educationists.
- (6) The principals of colleges should have full discretion to decide matters relating to the building up of educational facilities in their institutions, within the financial ceilings and policy guidelines laid down. The principal or his nominee should be the chairman of all subcommittees set up for the development of courses and facilities and should have full disciplinary powers vested in him in respect of the appointment of staff.

ANNEXURE

15.87 COURSES OF FURTHER EDUCATION

An Illustrative List

The need for further education for school-leavers has been discussed in several chapters. We list below a few such courses which can be considered for adoption. These can be on full-time, part-time or sandwich basis with adequate built-in flexibility regarding duration and contents to suit particular branches of study and local needs.

The list is to be taken as purely illustrative. The courses given are, to a considerable extent, drawn from the UK publication *Statistics of Education* 1963 (Part II, HMSO 1964) and adapted to Indian conditions on the basis of the publications of the Small Scale Industries and All India Khadi and Village Industries organizations. They include particular skills, groups of skills, and small scale industries.

I. *Agriculture and Allied Courses.* (1) Farm organization and management; (2) Forestry; (3) Fibre industry; (4) Gur and Khandsari industry; (5) Horticulture; (6) Poultry practice; (7) Palm gur industry; (8) Spinning and weaving; and (9) Village oil industry.

II. *Art and Design.* (1) Architecture; (2) Fashion design; (3) Furniture design; (4) Industrial design; (5) Interior decoration; (6) Landscape architecture; (7) Sculpture; and (8) Textile design.

III. *Business Administration.* (1) Accountancy; (2) Advertising; (3) Book-keeping; (4) Company and Secretarial practice; (5) Estate management; (6) Hospital administration; (7) Insurance; (8) Industrial Foremanship; (9) Librarianship; (10) Local Government and Public Administration; (11) Marketing; (12) Managerial training; (13) Office management; (14) Personnel management; (15) Salesmanship; (16) Shop assistants; (17) Windowdressing and display; and (18) Works management.

IV. *Food Trades.* (1) Bakery and confectionery; (2) Chocolate making; (3) Food inspection and analysis; (4) Food technology; (5) Milk pasteurization process and distribution; and (6) Warehousing.

V. *Health and Welfare.* (1) Child care; (2) Dental nurses/assistants;

(3) Dispensing assistants; (4) Dispensing opticians; (5) Health visitors; (6) Midwifery; (7) Medical laboratory technicians; (8) Pharmacy; (9) Psychotherapy; (10) Public health inspection; and (11) Speechtherapy.

VI. *Home Economics*. (1) Cookery; (2) Domestic subjects; (3) Dress making; (4) Home management; (5) Millinery; (6) Needlework and embroidery; (7) Tailoring; and (8) Upholstery.

VII. *Music and Drama*.

VIII. *Natural Sciences/Biological Sciences (Elementary)*. (1) *Applied Biology*. (a) Bacteriology; (b) Biochemistry; (c) Botany; (d) Physiology; and (e) Zoology; (2) *Mathematics*. (a) Computing; and (b) Statistics; (3) *Applied Physics*; (4) *Other Sciences*. (a) Timber Technology; and (b) Veterinary science.

IX. *Printing and Book Production*. (1) Book production; (2) Book-binding; (3) Electro and Stereotyping; (4) Lino composition; (5) Lithographic printing; (6) Monotype composition; (7) Photo engraving; (8) Photo-lithography; (9) Printing (general); and (10) Printing war-house practical.

X. *Wholesale and Retail Trades*. (1) Flower Display; (2) Grocery; (3) Meat trade and meat distribution; (4) Other food distribution; (5) Paper Merchandising; and (6) Retail management and storckeping.

XI. *Leather-based Industries*. (1) Tannery; (2) Leather goods manufacturing; (3) Footwear; (4) Leather for sports goods; and (5) Upholstery leather.

XII. *Sports Goods Industries*.

XIII. *Wood-based Industries*. (1) Boat building; (2) Carpentry; (3) Doors and windows on commercial basis; (4) Furniture; (5) Handloom and its accessories; (6) Pencil making; (7) Packing cases; (8) Photo frames; (9) Radio cabinets; and (10) Toys.

XIV. *Chemical Industries*. (1) Boot polish manufacture; (2) Bakelite manufacture; (3) Carbon papers and typewriter ribbons; (4) Cattle feed; (5) Ceramics; (6) Cosmetics; (7) Cutlery; (8) Drawing and filter papers; (9) Dyeing; (10) Electroplating; (11) Fire bricks; (12) Fruit and vegetable preservation; (13) Food colours; (14) Fish curing; (15) Glass toys; (16) Hot dip galvanising; (17) Low

tension porcelain insulators; (18) Matches; (19) Mirrors; (20) Metal polishing; (21) Nylon fishing nets; (22) Plastics; (23) Plaster of Paris; (24) Pigments; (25) Retreading motor tyres; (26) Rubber canvas transmission belts; (27) Rubber toys; (28) Sealing wax; (29) Stone-ware jars; (30) Slates; (31) Salt glazed sewer pipes; (32) Scientific glass apparatus; (33) Soap making; (34) Synthetic textiles; (35) Tin plating; (36) Vacuum flasks; (37) Writing inks manufacture; and (38) Water-proof packing paper.

XV. *Civil Engineering.* (1) Building; (2) Brick work; (3) Carpentry and joinery; (4) Concrete technology; (5) Costing and estimating; (6) Furnace brick work; (7) Glazing; (8) Heating and ventilating; (9) Plastering; (10) Plumbing and sanitary engineering; (11) Roof slating and tiling; (12) Structural engineering; (13) Surveying; (14) Town planning; and (15) Wall and floor tiling including mosaic work.

XVI. *Electrical Engineering.* (1) Domestic wiring; (2) Domestic electric appliances; (3) Electrical accessories; (4) Electric fans; (5) Electric horns; (6) Fluorescent tubes; (7) Loud speakers; (8) Motor winding; (9) Refrigerators servicing; (10) Radio chassis; (11) Radio & television servicing; (12) Storage batteries manufacture; and (13) Small transformers.

XVII. *Engineering—General.* (1) Agricultural implements; (2) Blacksmithy; (3) Bicycle parts; (4) Case hardening of steel; (5) Corrosion engineering; (6) Drawing boards and accessories; (7) Fittings; (8) Foundry; (9) Hand tools; (10) Heat treatment; (11) Instrument engineering; (12) Metalware; (13) Motor vehicle servicing; (14) Motor vehicles painting; (15) Mechanical toys; (16) Pattern making; (17) Pumps & pipe fittings; (18) Quarrying; (19) Steel furniture; (20) Sewing machine attachments; (21) Scales manufacture; (22) Sheet metal work; (23) Water metres; and (24) Welding.

XVIII. *Miscellaneous.* (1) Bee-keeping; (2) Cinema and film studio work; (3) Ebony handicraft; (4) Gobar gas; (5) Goldsmithy and silver-smithy; (6) Hair-dressing and allied services; (7) Jewellery manufacture; (8) Laundry and dry-cleaning work; (9) Lime manufacture; (10) Musical instruments; (11) Newar weaving; (12) Pottery; (13) Tobacco processing; (14) Woollen goods; (15) Other personal services; and (16) Manufacture of miscellaneous articles of daily use.

SUMMARY

1 (1) A concerted and sustained programme is needed to ensure that by 1986, some 20 per cent of all enrolments at the lower secondary level and some 50 per cent beyond class X are in part-time or full-time vocational and professional courses.

(2) Vocational education courses at school stage should be predominantly terminal in character, with adequate opportunities, for the exceptionally gifted child, to rejoin the mainstream and move higher, through further study. 15.09-10

2 *Training Semi-Skilled and Skilled Workers.* (1) There should be a further expansion of facilities in ITIs, beginning by at least a doubling of available places in the Fourth Plan. The minimum admission age should be gradually lowered to 14, with suitable adjustments in courses.

(2) Junior Technical Schools should be renamed Technical High Schools and along with the existing Technical High Schools should offer courses clearly terminal in character. There should be greater use of available time to meet the requirements of the Apprenticeship Act. Enough flexibility and experimentation should be permitted in the organization of the various courses.

(3) Training in ITIs and technical schools must be production-oriented.

(4) Skilled workers' training courses with entry requirements below class X should also be attached to polytechnics to make better use of existing facilities.

(5) Facilities for vocational and technical training for school leavers entering employment should be greatly expanded on a part-time, day-release, correspondence, sandwich or short-intensive course basis. Rigidity of approach in the organization of these courses should be avoided. 15.12-18

3 *Technician Training.* (1) The overall ratio of engineers to technicians should be raised from the present figure of 1:1.4 to 1:2.5 by 1975 and to 1:3 or 4 by 1986.

(2) Courses for the training of technicians should be revised in the light of periodic investigations to be carried out in cooperation with industry, aimed at job analysis and specifications in terms of levels and clusters of skills and responsibilities for technicians.

(3) Diploma training should be more practical, by including industrial

experience. This practical training should be of a project or problem-oriented type.

(4) Polytechnics should be located only in industrial areas, while those already functioning in rural areas should develop courses allied to agriculture and agro-industries.

(5) Teachers for polytechnics should be increasingly recruited from industry, by relaxing, if necessary, academic admission requirements. Salaries should not be linked to academic qualifications only.

(6) To give training in as near realistic conditions as possible, vacations should be used by the students and staff to do production work on simple tools either for equipping secondary schools or for sale.

(7) Teaching of science and mathematics in polytechnics should be strengthened, particularly in the first two years. Technician courses should include introduction to industrial psychology and management, costing and estimation.

(8) Polytechnics should increasingly adopt sandwich type of courses in cooperation with industry.

(9) In view of low mobility of diploma holders in the country, the courses offered in polytechnics during the Fourth and Fifth Plans should be designed largely with local requirements in view, keeping at the same time, a watchful eye on total national needs.

(10) Courses of special interest to girls should be offered in all polytechnics at both the certificate and diploma levels and girls completing the lower secondary course should be encouraged to take them up.

(11) Every effort must be made to reduce the present high wastage rates in polytechnics to a minimum and to expand existing polytechnics to their optimum size.

(12) Selected polytechnics should provide post-diploma courses for technicians with some years of experience in industry to qualify as higher level technicians.

15.19-32

4 *Other Vocational Education.* (1) At the higher secondary level (classes XI & XII), alongside the polytechnics, there is considerable scope for starting a range of interesting courses in commercial, clerical, scientific and industrial trades and in areas of special interest to girls. This should be fully exploited.

(2) Products of Technical High Schools and polytechnics should be encouraged to set up small enterprises of their own or to join together with others in creating small-scale workshops, industries and services needed in the community.

15.33-36

5 *Education of Engineers.* (1) All institutions not conforming to the

standards should be improved, converted to institutions training technicians or closed.

(2) For selected branches of engineering such as electronics and instrumentation, recruitment of well-qualified B.Sc. students should be encouraged, with courses suitably adjusted.

(3) Anomalies in the scales of pay between staff members in science and technology faculties in engineering institutions should be removed. An appropriate number of posts in each of these faculties should be reserved for well-qualified persons of the other faculty.

(4) Practical training for full-time degree students should commence from the third year of the course, and should be properly prepared and supervised in cooperation with the industry. Wherever possible, sandwich type of courses should be adopted.

(5) Workshop practice should be more production-oriented.

(6) Courses at both degree and diploma levels should be diversified to meet the changing needs.

(7) For colleges and institutes of technology to become more concerned with the needs of industry, research design projects sponsored either by industry or government should be made a part of the curriculum.

(8) Syllabus should be continually revised in consultation with expert committees, carefully avoiding any rigid conformity.

(9) Development of courses and manpower estimates in new fields such as electronics, instrument technology including automation, chemical technology, aeronautics and astronautics, and nuclear power generation should be carefully planned in advance.

(10) *Teachers.* Teachers should be allowed to undertake consultancy for industry. Widespread summer institutes should be organized.

(11) Suitable salary scales should be offered to make the profession attractive and to ensure that well-qualified engineers may work in teaching and research for significant periods in their careers.

(12) Institutes of technology should undertake large scale teacher training programmes for graduate and postgraduate students. All such courses should include a study of a second modern 'world language' such as Russian or German. The scheme for centres of advanced study should be extended to cover technological field also.

(13) Frequent transfers of teachers and principals in Government colleges for other than professional reasons must be stopped.

(14) *Equipment.* Special consideration should be paid for the timely release of foreign exchange and the stock-piling of essential equipment.

(15) Polytechnics should be discouraged from acquiring sophisticated equipment which is used for only a few days in the year.

(16) Institutions should be encouraged to manufacture prototype substitutes for imported items of equipment.

(17) *Postgraduate Courses.* Admission requirements to these courses should include at least one year's experience within industry. Rigid uniformity in the organization of these courses is not desirable.

(18) Research at this level should be diverted towards problems of industry. Larger numbers of those taking up postgraduate courses should be sponsored by industry.

(19) A regular doctorate degree for professional development work within industry in addition to a Ph.D. research degree should be created.

(20) Indiscriminate proliferation of courses should be avoided and location of highly specialized courses should be determined at the national level.

(21) The practice of levying capitation fee for awarding seats in engineering colleges should be stopped. 15.37-61

6 *Manpower Requirements.* (1) There is need for rigorous and more refined studies for estimating technical manpower requirements at all levels. Opening of new training facilities and admissions to courses should be linked to such forecasts.

(2) In the immediate future, attention should be given to the elimination of present high wastage rates at all levels and to improvement in quality of instruction offered. Existing facilities should be expanded to their optimum size and part-time courses developed for those already in employment.

(3) Existing marked variations in the socio-economic background of students in technical institutions can be reduced by a greater equalization of educational attainments in secondary schools between urban and rural areas and by adoption of better admission tests. 15.62-64

7 *Medium of Education.* At the secondary and polytechnic stages, the regional language should be the medium of instruction. Its use at higher levels should be related to the position in science faculties. Vigorous action is required for the preparation of good technical textbooks in regional languages. 15.65

8 *Practical Training.* Industrial concerns or departments selected under the Central Government Practical Training Scheme as also the trainees, should be carefully chosen. The number of training places needs to be increased. If for any reason, the apprenticeship schools started by some public sector undertakings are to be closed down, Central Government should take them over. 15.66-69

9 *Cooperation with Industry.* A Central scheme of subsidy to industrial concerns providing training facilities should be started. Suitably qualified training officers should be posted to such industry or groups of industries. 15.70

10 *Professional Societies.* Adequate safeguards have to be devised to ensure that requisite standards are maintained by the professional bodies in all the examinations conducted by them. These professional societies should also be associated with the recommended programme of organizing a wide range of part-time technical courses at higher secondary level (classes XI and XII). 15.71-73

11 *Correspondence Courses.* An immediate beginning should be made to develop a wide range of vocational and technical courses through correspondence. However, before this medium could be adopted extensively, very careful preparation and testing would be required. 15.74-75

12 *Administration.* (1) A UGC-type organization for technical education with a full-time chairman should be set up with adequate representation for UGC, professional bodies, industry and concerned Ministries.

(2) The Institutes of Technology and comparable institutions should be given full university status, while retaining their individual names and characteristics.

(3) As part of Boards of School Education, Directorates of Technical Education should be set up at the State level, with adequate powers, among other things, for recruitment of staff thus removing a number of procedural delays.

(4) Chairman of Boards of Governors of Regional Engineering Colleges should be drawn from a panel of distinguished educationists.

(5) Principals of colleges should have, among other powers, full discretion in matters relating to the building up of educational facilities in their institutions within financial ceilings and policy guidelines. 15.76-86

CHAPTER XVI

SCIENCE EDUCATION AND RESEARCH

16.01 The basic approach and philosophy underlying the reconstruction of education adopted by us in this Report rests on our deep conviction that the progress, welfare and security of the nation depend critically on a rapid, planned and sustained growth in the quality and extent of education and research in science and technology. Science has radically transformed man's material environment. In the technologically advanced countries the average span of human life has increased by more than a third over the last hundred years. Science is universal and so *can* be its benefits. Its material benefits are immense and far-reaching—industrialization of agriculture and release of nuclear energy, to mention two examples—but even more profound is its contribution to culture. Science is liberating and enriching of the mind and enlarging of the human spirit. Its fundamental characteristic has turned out to be the possibility of unlimited growth. Every advance in science deepens our understanding of Nature but it also heightens the sense of ignorance. *Nature is inexhaustibly knowable*. Nothing comparable to the scientific revolution in its impact on man's development and outlook has happened since the neolithic times.

16.02 *Rapid Rate of Growth*. Science represents a cumulative and cooperative activity of mankind and its rate of growth is extremely rapid. A number of indices, such as the output of research papers or the number of scientists and engineers or the consumption of energy, indicate that the *doubling period* of science, and activities directly related to science, is some ten to fifteen years. It is not at all clear why this should be so; and why the doubling time should have nearly remained constant over the last three hundred years since the beginning of the scientific revolution in Western Europe. A doubling time of ten years means that a decade from now the volume of new knowledge gained will equal nearly that accumulated over the past several centuries. The total number of science journals was about a thousand a hundred years ago. The number now stands at a hundred thousand.¹⁸⁶ By the end of the present century it is expected to reach a million. The number of scientists has been doubling every ten years. Such a growth rate

¹⁸⁶ The number of 'surviving journals' is about 35,000; and the number of journals with a run longer than about 15 years is only a few hundred.

implies that at any given time the number of scientists alive is nearly ninety per cent of all who ever lived since the beginning of science. So rapid is the growth of science that, as some people have put it, a scientific paper is often out of date by the time it is in print; a book is out of date before a student has completed the course; a graduate is obsolescent on the day of his graduation; and a research equipment is often out of fashion by the time it is procured. Again, it is characteristic of expanding science and technology that the time gap between basic discovery and its application is continually diminishing. It was a few decades a hundred years ago, it is a few years, now. Of course, the exponential rate of growth of science cannot continue indefinitely. For example, if the present rate of increase in the number of scientists were to continue for another hundred years, the number of scientists would almost equal the total world population, an obvious impossibility. Sooner or later, therefore, the growth rate must slow down, and perhaps level off eventually with the growth rate of population. The first signs of an approach to this stage are, perhaps, becoming evident in some of the scientifically advanced countries. For instance, the growth rate of research and development expenditure which was about 15 per cent per year for more than a decade in the USA and UK is now slowing down considerably.

16.03 *Quality in Science Education.* Science has added a new dimension to education and to its role in the life of a nation, but central to all this is the quality of education. If science is poorly taught and badly learnt, it is little more than burdening the mind with dead information, and it could degenerate even into a new superstition. What we desperately need is improvement in the standard and quality of science education at all levels in the country. Strengthening university science and research must be treated as a fundamental national goal. Strong and progressive universities constitute the foundation of all research and development effort of the nation. To achieve quality in science education and research demands serious and sustained effort, full and vigorous government and public support, a relentless pursuit of excellence, and above all it needs determination, hard work and dedication.

16.04 *Major Steps and Programmes for Strengthening Science Education and Research.* We shall describe a number of steps and action-programmes which we believe essential for strengthening of science and research. Some of these are listed below:

- recognition that teaching and research are mutually supporting activities. High quality teaching in science is possible only in a research environment—research is essential for its sustenance.

- basic research should be conducted largely within universities; and to train research workers should be their major responsibility. Laboratories for basic research, unless there be compelling reasons, should not be set up divorced from teaching.
- promotion of effective cooperation (joint research projects, training of postgraduate and research students, exchange of staff, etc.) between institutions of higher education and national laboratories and industrial and government scientific establishments/organizations;
- Centres of Advanced Study: development of existing centres and setting up of new centres, and 'clusters of centres'; the centres should serve as a major source of supply of teachers and researchers to other institutions;
- modernization of curricula; stress on experimental and field work;
- science education at all levels should be strongly reinforced through study of applications to local environment and industry;
- improvement of laboratories and libraries;
- special attention to gifted students;
- development of laboratory workshops and facilities for servicing, repair and fabrication of scientific apparatus; training of laboratory technicians;
- organization of courses in interdisciplinary fields, and in subjects of special scientific and industrial importance;
- special attention to development of mathematical studies and research;
- production (on a national basis) of 'quality books' for undergraduate and postgraduate education;
- constitution of an effective body to advise Government on science policy, including priorities in allocation of funds for different sectors of research;
- national organization (academy) of scientists; its major role in raising quality of research and of national publications and journals in science and technology; promotion of international relations in science; and
- vigorous and continuing effort to forge strong links between science, technology and production. A high level of science education and research and a strong industrial and agricultural base go together: the three elements in the S.T.P. triad reinforce and accelerate the development of one another.

16.05 *Selective Approach.* The Report can do no more than create an awareness of the challenge we face—its urgency and magnitude—and indicate broadly the lines on which we should proceed. What is needed

most to bring about a radical improvement in the present situation is a rigorously *selective approach*, a concentration of effort to build centres or peaks of excellence to serve as pace-setters and 'breeders' of more centres of excellence. It implies that the scale of support to institutions is determined on the basis of national needs and their level of performance, capabilities and potentiality for growth and development. No country, affluent or poor, can afford to squander its resources on institutions which are of indifferent quality and determined to remain stagnant. When resources are scarce and problems formidable, the principle of concentration and selectivity becomes all the more imperative. Of course, it has to be applied not mechanically but imaginatively and wisely.

16.06 *Some Definitions.* In this chapter and in the Report generally we use the terms science, and scientist, in two senses, *general* and *limited*. (The word scientist was first used in 1840 by William Whewell, Master of Trinity College, Cambridge.) In its general sense 'science' covers the entire spectrum of scientific knowledge, pure and applied, extending from mathematics and basic science subjects to metallurgy, engineering and agriculture.¹⁸⁷ In its limited sense, science stands for pure or basic science subjects such as physics, chemistry, biology, biochemistry and geology. In the case of basic science subjects the main concern is with the discovery of fundamental laws and operations and of gaining insight into the working of nature. Applied science deals with application of basic sciences to meet man's diverse material and cultural needs, and it includes all engineering and technological subjects. The term research includes 'pure research' and 'applied research'. We use pure research and basic research as equivalent terms. Applied research does not include 'development' which is a stage linking applied research to production. We use the term *R and D* to include the whole spectrum of research and development activities, including design and testing of prototypes.¹⁸⁸ Development is usually the most costly activity of all.

16.07 It should be recognized that the distinction between pure science and applied science, and between basic and applied research, as also between research and development, which was well-defined a few decades ago is now getting less and less sharp. In some fields hardly any distinction can be drawn. In fact, the great strength of contemporary

¹⁸⁷ In the USSR and the Continent of Europe the term *science* has a much wider connotation. It also includes economics, social sciences and allied subjects.

¹⁸⁸ The Report (1961) of the Committee on the *Management Control of Research and Development in the UK* (Chairman Sir Solly Zuckerman) has differentiated under the term *R and D*, five categories of activity. These are: pure basic research, objective basic research, applied (project) research, applied (operational) research and development.

science lies in the close interaction and mingling of basic and applied sciences.¹⁸⁹

16.08 *New Development.* It is almost certain that in the next decade or two we may see unravelling of the details of the genetic code, and with it a rapid progress in the cure of hereditary diseases and eventually a partial control of the progress of man's evolution itself. Advances in molecular neurology and understanding of the process in the brain may provide new means of influencing and modifying man's mental state. Manned flights will be achieved not only to the moon, but possibly also to other planets. The discovery, when it comes, of life (intelligent life, who knows?) outside the earth will have the most profound consequences for man's development and his future destiny. It is almost certain that within the next ten years communication satellites will be able to picture broadcasts to domestic TV-receivers anywhere in the world, thus opening up revolutionary possibilities for education. Progress in computer technology is likely to revolutionize, through cybernetics and automation, many aspects of man's life. The study of *quasars* may bring to light some entirely unsuspected process of energy generation, and provide new clues to the origin of the universe. New discoveries in high-energy physics may provide an altogether new insight into the nature of sub-atomic particles. Godel's epochal work on the axiomatic foundations of mathematics has revealed an inherent limitation of mathematical reasoning and logic which has far-reaching philosophical implications.

16.09 There is no doubt that to several of these and other exciting fields India will make contributions of some significance, but it is certain that the shape, quality and volume of future science in the coming decades will be determined essentially by the work of the countries which are in the forefront of science today. This simple fact has far-reaching consequences for us. It implies that our university courses, specially at the postgraduate stage, and research activities will be largely fashioned and determined by developments which will occur outside the country. It underscores the importance in our system of education of the study of English and other world languages, and of giving a high priority to an energetic expansion on a big scale of library facilities so that we could derive full benefit from the rapidly growing world-stock of science and technology. Above all it means that no effort should be spared to identify the truly gifted individuals and to give them every possible opportunity and encouragement for the unfolding of their innate abilities and creative potential.

¹⁸⁹ H. J. Bhabha, J. D. Cockcroft and P. A. M. Dirac, three top-ranking physicists, had their first degrees in engineering.

INVESTMENT IN EDUCATION & RESEARCH AND NATIONAL PRODUCTIVITY

16.10 Let us for a moment compare the expenditure on higher education in India and the industrially advanced countries. It is an interesting statistical fact that the average expenditure on higher education per student per year, in almost every country is of the same order as the GNP *per capita*.¹⁹⁰ For example, the expenditure per student per year in our country is about one-thirtieth of that in the U.K. The cost of scientific instruments and apparatus is about the same in the two countries. Further, India has largely to import special apparatus required for advanced study and research. This needs foreign exchange which is in very short supply. It is in a sense inevitable that the level of laboratory equipment and other basic facilities (including books and journals) available to an Indian student will be, on an average, far below that available to students in highly industrialized countries. It may also be noted that in the scientifically advanced countries the cost per student in pure science, in undergraduate and postgraduate courses, is roughly the same as that in engineering and agriculture. The expenditure per student in the universities in the UK for 1963-64 was: Art £501; Social Sciences £465; Pure Science £757; Applied Science £671; Agriculture £916 and Medicine £1,078.¹⁹¹ The USA figures faculty-wise are Humanities \$3,200, Education \$3,300; Social Sciences \$3,250; Biological Sciences \$3,374; Physical Sciences and Mathematics \$3,380; Engineering \$4,020.¹⁹² In India the average cost per student in pure science is much less than that for engineering. This is because our science laboratories in general are very poorly equipped and very little attention is paid to practical work and demonstration experiments.¹⁹³

16.11 The industrialized countries have a much higher GNP *per capita* and thus can, and do, invest in education and research on a scale higher by orders of magnitude than the under-industrialized parts of the world.¹⁹⁴ A highly industrialized country needs for the bulk of its

¹⁹⁰ The relationship does not hold for some of the African countries which spend on higher education per student about as much as the highly industrialized countries, but their enrolments in higher education are proportionately extremely small.

¹⁹¹ Source, Fifth Report of the Estimate Committee—*Grants to Universities and Colleges* (U.K., July 1965).

¹⁹² The President's Science Advisory Committee Report on *Meeting Manpower Needs in Science and Technology*.

¹⁹³ It is worth recalling that according to the Report of the Indian Education Commission of 1882 the average cost per student in government colleges at that time was about Rs. 350 per year which in terms of current price-level would be roughly ten times higher than what we spend today. As against this fall in the cost per student, the enrolment in higher education has increased nearly a thousand-fold.

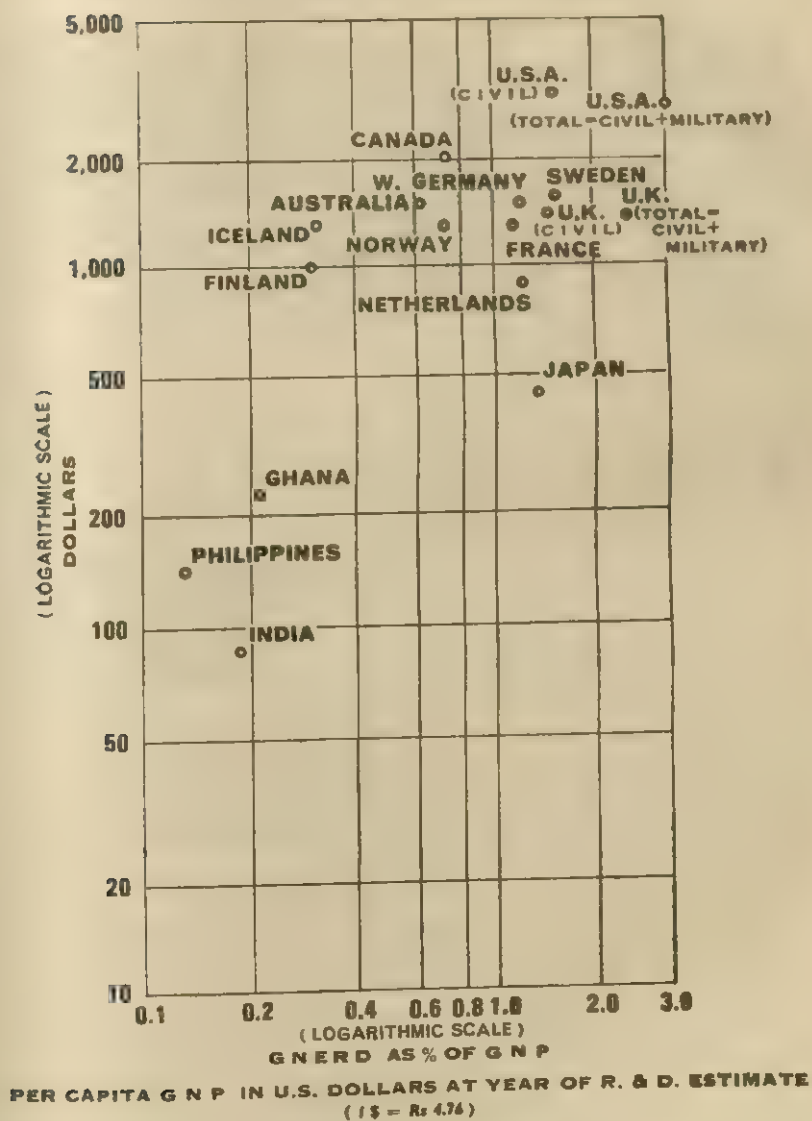
¹⁹⁴ Thus, for example, the US expenditure on higher education was 0.26 per cent of the GNP in 1900. It rose to 1.23 per cent in 1960. The expenditure, per year per student, in higher education rose from \$ 574 in 1930 to \$ 1,747 in 1960 (at current prices). The increased cost accounts for rise in salaries of teachers, better staff-student ratio and improvement in general facilities. (F. Machlup, *Production and Distribution of Knowledge in the U.S.*, Princeton University, 1962, p. 78)

scientists and engineers a much higher level of education and training than does an under-industrialized country. At the present level of our national economy the education of a vast majority of scientists and engineers cannot be at the level reached by the highly industrialized countries. However, when it comes to postgraduate studies and research, and the training of those who will become leaders in their professions, the standard of attainment must bear international comparisons. For our best we must aim to provide the best education according to international standards. The only way this can be done is through a most careful selection of subjects for advanced study and research, selection of the most able students for such courses, and by building a small number of centres of excellence and assigning to each of these resources exceeding a certain critical size. These centres will determine the general tone of scientific work in the country and would serve as 'growing points' for excellence.

16.12 It may be of interest to pursue a little further the connection between national productivity and investment on education and research. That there is a close inter-connection, a coupling, between them is apparent from a glance at Table 16.7 appearing later in the chapter. It is also vividly brought out by charts on pages 725 and 726. The relationship is essentially an expression of the fact that the modern world is science and technology based. However, it is not to be interpreted as a simple cause-and-effect relationship. A country would not automatically become prosperous by merely ploughing in more money into education and research. In fact it could also have the opposite effect. What the relationship implies is that science education and research of the right type and geared to national needs will lead to a rise in productivity. The increased productivity in its turn would provide more resources for science and research, and thus will be generated the rising (S-T-P) spiral of science, technology and productivity.

16.13 It is unfortunate that India today is almost at the bottom end of the ladder of GNP *per capita*, as also of the ladder of *per capita* expenditure on education and research. The Indian expenditure on education from primary to higher, and research and development, is about Rs. 15 *per capita* per year: it is about 3 per cent of the GNP. The corresponding figure for the USA is Rs. 2,000 (at 10 per cent of the GNP). By the end of the century the *per capita* Indian expenditure on education and research, on most optimistic projections, may go up to Rs. 200 per year (at constant prices)—this would be as high as nearly ten per cent of the *per capita* GNP at that time. The corresponding figure for the USA is likely to exceed Rs. 10,000 per year. The big gap of today would become far bigger in the coming decades. Even if we cannot foresee all the far-reaching consequences inherent in such a situation, the moral for us

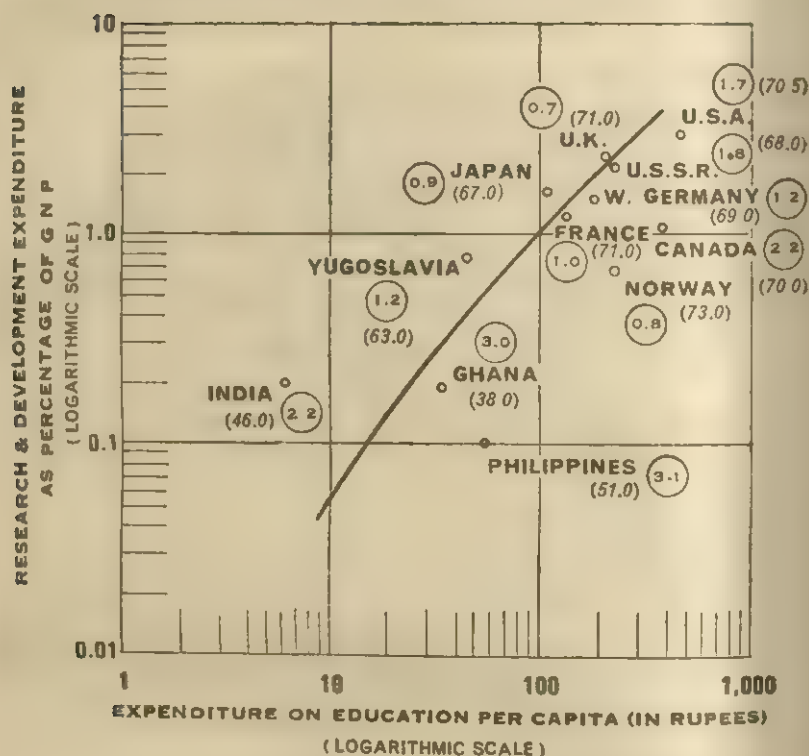
Research & Development Expenditure in Relation to Per Capita GNP at Market Prices, 1961 (or Nearest Year)



SOURCE : SCIENCE, ECONOMIC GROWTH & GOVERNMENT POLICY, O.E.C.D., PARIS, 1963.

Fig. 27

Investment in Science versus Investment in Man



Number in brackets indicates expectancy of life (in years) at birth.

Figure in circle indicates the rate of increase of population (1958-61) per cent per year.

NOTE: (1 \$ = Rs 4.76)

Fig. 28

is plain. In the utilization of our scientific manpower, we must strive our utmost to achieve high efficiency—higher even than that of the industrially developed countries, if we can. As the number of competent scientists and technologists available at any time is severely limited, hard and sometimes unpleasant choices have to be made between alternative programmes and courses of action. This cannot be evaded—it is inherent in the very nature of things. There is no place for complacency, but equally none for losing heart or being swept off the feet. The one thing that is supremely necessary in an age of rapid change and radical innovation is that we determine our priorities and programmes in education and research on the basis of hard 'indigenous' thinking and needs, and not follow the fashion set by other countries whether highly 'advanced' or not so advanced. For instance, if we set as a goal to produce as many doctorates in physics as the USA is doing currently, it will be senseless not only because it is impossible of attainment in the foreseeable future, but because of its irrelevance to our needs and aspirations.¹⁹⁵

16.14 If science is to be pursued with full vigour and zest and is to become a mighty force in the Indian renaissance, it must derive its 'nourishment' from our cultural and spiritual heritage and not bypass it. Science must become an integral part of our cultural fabric. It is possible that when science takes root in the native soil, and is no longer an exotic plant, its growth pattern may be visibly influenced by those features which have been characteristic of Indian philosophic thought and civilization. Part of the science 'fashion' may be set by us reflecting Indian ethos and value judgements. Let us also remember that thinking and creativity have a considerable element of the preconscious. All is not well with the way science has developed in the western world (or rather the 'northern world'). There are people who are seriously perturbed by the imbalance between the growth of science and awareness of the true interests and welfare of mankind as a whole. Knowledge and wisdom, power and compassion, are out of balance. Max Born, one of the greatest physicists of our time, has given expression to these fears and doubts thus: 'Though I love science I have the feeling that it is so much against history and tradition that it cannot be absorbed by our civilization. The political and military horrors and the complete breakdown of ethics which I have witnessed during my life may be not a symptom of an ephemeral social weakness but a necessary consequence of the rise of

¹⁹⁵ The current output of doctorates in science and technology in the USA exceeds the output of M.Sc.'s in our country. The number of new Ph.D.s in physics in the USA was about 700 in 1963; and the total stock of Ph. D. physicists 7,630. The total support for basic physics in 1963 was about \$ 500 million. The NAS Panel Report (*Physics: Survey and Outlook 1966*) has urged that this be raised to 1.1 billion dollars by 1969. The number of science and engineering doctorates awarded in 1920 in the USA was 400; it rose to 6,600 in 1960 and is expected to exceed 13,000 by 1970. This implies a doubling every 12 years.

science—which in itself is one of the highest intellectual achievements of man. If this is so, there will be an end to man as a free, responsible being. Should the race not be extinguished by a nuclear war it will degenerate into a flock of stupid, dumb creatures under the tyranny of dictators who rule them with the help of machines and electronic computers.¹⁹⁶

SCIENCE EDUCATION

16.15 While science is expanding at a terrific pace, till very recently even in the educationally advanced countries, little attention was paid to any serious improvement and innovation in the teaching of science and mathematics. In particular, school and college mathematics has been grossly out of date, in content as well as in method and approach, and takes no account of the profound discoveries made during the last 100 years or more. In the last decade the US National Science Foundation, as also the Soviet Academy of Sciences and the Academy of Pedagogical Sciences, have made a pioneering contribution towards initiating a 'revolution' in the teaching of science and mathematics. A significant contribution has also been made by the Nuffield Science Foundation which has developed new curriculum materials at the school level. The movement is now spreading to many countries. Fortunately for the entire process of improving school and college science and mathematics, top university teachers and researchers have become directly involved in this process. The contribution of Professor Jerrald R. Zacharias of the M.I.T., Boston, will, for instance, ever remain memorable in this field.

16.16 In this context it is important to recognize that science is becoming increasingly complex and abstract. The new developments in physics and mathematics make altogether novel demands on abstraction and conceptualization of nature. Referring to the progress in theoretical physics during recent years, P. A. M. Dirac observes: 'Her (Nature's) fundamental laws do not govern the world as it appears in our mental picture in any very direct way, but instead they control a substratum of which we cannot form a mental picture without introducing irrelevances... This state of affairs is very satisfactory from a philosophical point of view, as implying an increasing recognition of the part played by the observer in himself introducing the regularities that appear in his observations, and a lack of arbitrariness in the ways of nature, but it makes things less easy for the learner of physics. Like the fundamental concepts (e.g., proximity, identity) which every one must learn on his arrival into the world, the newer concepts of physics can be mastered only by long familiarity with their properties and uses.'

¹⁹⁶ *Bulletin of the Atomic Scientists*, February 1966.

16.17 All this emphasizes the need from the earliest stage of science education for a proper understanding of the basic principles and the process of scientific abstraction and creative thinking. It must communicate to the pupils a feeling for discovery and creativity, and a realization that science is open-ended and man's greatest intellectual enterprise today. And what is more important, this enterprise is rooted in man's highest aspirations and deepest motivations, and it stresses cooperation above competition. Science teaching at all levels has to be creative teaching. It also means that a deliberate effort should be made to develop in the pupils the habits of concentration and contemplation. If the quality of education has to be improved, something will have to be done to each of the millions of individual pupils; and this emphasizes the importance of activating and renovating every individual teacher. The magnitude of the problems we face is truly immense.

16.18 *Expansion of Enrolments: Supply of Teachers.* In recent years, and more so since Independence (1947), the number of young people graduating in science and technology in India has been increasing rapidly.¹⁹⁷ This is a welcome trend. It represents a growing awareness and desire for education in science and science-based courses. It is also stimulated by the larger possibilities of profitable employment open to graduates in science and technology. The number of people who received B.Sc. degrees in science subjects in 1963 was 31,638 as against only 9,628 in 1950. The corresponding figures for engineering and technology are 9,227 and 1,660 and for agriculture (including veterinary science) 4,872 and 1,100 respectively. The number of doctorate degrees in science and technology has increased during this period from about 100 to 540.

16.19 Let us see how these outputs compare with the total population

¹⁹⁷ Science teaching in India first began, it seems, in the Calcutta Hindu College (which later became the Presidency College) founded in 1817 due to the initiative of Raja Rammohan Roy. It took a hundred years before serious postgraduate work and research started in the country. An outstanding event was the establishment of the Calcutta University College of Science under the leadership of the late Sir Asutosh Mookerjee.

The scientific revolution started in Western Europe some three hundred years ago, but it is less than a hundred years that science found a proper home in the universities of the Western world. In 1858 Michael Faraday urged: 'As a branch of learning, men are beginning to recognize the right of science to its own particular place; (but) now the fitness of university degrees in science is under consideration, and many are taking a high view of it, as distinguished from literature, and think that it may well be studied for its own sake i.e., as a proper exercise of the human intelligence, able to bring into action and development all powers of the mind.' (*Proceedings of the Royal Institute, London, 1858.*)

The *Indian Education Commission Report of 1882* records that in that year, in all subjects, 266 Bachelor's degrees and 40 Master's degrees were awarded. Incidentally, the failure rate at the Bachelor's examinations at that time was about the same as generally prevailing in India today: it was about 60 per cent.

As a sharp reminder of the relative backwardness of Indian education it may be noted that in the year 1880 in the USA 12,896 Bachelor's and first professional degrees, 879 Master's or second professional degrees, and 54 Doctorate or equivalent degrees were awarded. The U.S. population in 1880 was about 50 million (F. Machlup, *Production and Distribution of Knowledge in the United States*, Princeton University, 1962, p. 91).

in the relevant age groups. It is sometimes helpful in discussing manpower problems, and making international comparisons, to view the output (and also the input) as a percentage of the corresponding age group. The average age at which the B.Sc. degree in science subjects is taken is about 20 years. This may be regarded as the median age and the age distribution is likely to have a variance of about a year. The M.Sc. degree in science subjects is taken at about 22 years, and the first degree in engineering and technology at about the same age. It may be noted that as regards the total duration of the course after completion of secondary education, it is our *M.Sc. degree in science which should be equated to the first degree (Bachelor's degree) in engineering, technology and agriculture*. The average age at which a doctorate degree is received may be taken to be about 26 years, but the variance in the age distribution will be much more than for the bachelor's degree.

16.20 The actual number of degrees awarded in 1950 and 1963, expressed as percentage of the corresponding age group, are given in Table 16.1.

TABLE 16.1 DEGREES AWARDED IN SCIENCE AND TECHNOLOGY IN 1950 AND 1963

Degrees	Number of degrees awarded		Percentage of the corresponding age-group		Average (compound) rate of growth per year
	1950	1963	1950	1963	
B.Sc.	9,628	31,638	0.14	0.37	9.6%
M.Sc. (excluding Mathematics)	861	4,478	0.013	0.055	13.6%
M.A./M.Sc. (Mathematics)	251	1,857	0.004	0.023	16.6%
Bachelor's degree in Technology (Engineering and other subjects) . . .	1,660	9,217	0.026	0.11	14.1%
Bachelor's degree in Agriculture and Veterinary Science	1,100	4,872	0.017	0.060	12.1%
Doctorate degree in Science and Technology .	100	540	..	..	13.9%

Source. University Grants Commission, *University Development in India 1964-65*.

16.21 The output of M.Sc.s in different science subjects in Indian universities since 1950 is given in Table 16.2. It may be noticed that the current output of M.Sc. in our country is *less* than the output in the USA

of *doctorates* in science and technology. The number of doctorates in science and engineering awarded in the USA rose from 400 in 1920 to 6,600 in 1960 and is expected to exceed 13,000 by 1970. This implies a doubling every twelve years. The current output of graduates in science and technology in the USA is about four per cent of the relevant age-group—it is about equally divided between the two fields. The percentage for the USSR is nearly the same, but the proportion of engineers is far more than scientists.

16.22 Apart from improving the standard of the postgraduate courses, the postgraduate enrolments in science and mathematics would need to be expanded *several-fold* in the coming decades to meet the demands of rapidly expanding secondary and higher education and of research and industry. We envisage an annual rate of increase of about 10 to 15 per cent. This would mean, that at the end of two decades, the numbers would be about ten times the present enrolments. To achieve such a large-scale expansion without diluting standards in the process is an extremely difficult task. It will require bold action and careful planning. It will need a massive financial support (including foreign exchange component) for the construction and equipping of new laboratories, and a most energetic and determined effort on the part of all concerned to recruit and train the teaching staff. The recruitment of new teachers every year will have to be at the rate of some 20 per cent of the current strength in order to meet the demands of increasing enrolments, present shortages, and replacements due to retirement and other causes. This places a special obligation on the Centres of Advanced Study and other quality departments and institutions. Through provision of liberal scholarships at the postgraduate and research level and other incentives, it should be ensured that *at least* a half of the output of the Centres join the teaching profession. The Academic Planning Board which we have elsewhere¹⁹⁸ recommended to be set up in every university, should assume a special responsibility for advanced planning of the requirements of academic staff: it should keep in touch with the relevant centres of advanced study, and wherever possible to preselect would-be staff members and arrange for their special training. There is always a scarcity of outstanding persons in any profession, and, if anything, it is more accentuated in science and mathematics. The top-ranking professionals are the nation's most precious asset, and everything possible should be done to use them to the best advantage of the country. An institution which has an outstanding staff should be encouraged to organize short-period special courses (from a few weeks to months) to which selected students (and also teachers) from other parts of the country would be invited. Also, it would be a distinct advantage if some of the

¹⁹⁸ See Chapter XIII.

TABLE 16.2 OUTPUT OF M.Sc.s (1950 to 1963) IN BASIC SCIENCE SUBJECTS

Subject	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Chemistry . . .	283	346	353	400	482	556	597	648	724	881	1,064	1,132	1,240	1,487
Mathematics . . .	121	180	233	253	399	437	475	601	572	731	687	855	1,002	1,094
Physics . . .	231	291	336	384	444	425	473	484	537	618	760	921	1,076	1,101
Botany . . .	82	115	137	156	172	234	270	286	265	366	418	473	553	632
Zoology . . .	115	124	159	190	195	241	257	249	263	334	434	526	567	648
Geology . . .	64	91	95	83	109	84	109	134	182	228	267	365	336	418
TOTAL . . .	896	1,147	1,313	1,466	1,801	1,977	2,181	2,402	2,543	3,158	3,630	4,272	4,774	5,380

Notes. 1. Chemistry includes (a) Applied Chemistry, (b) Analytical Chemistry, and (c) Biochemistry.

2. Mathematics includes Astronomy.

3. Physics includes (a) Bio-Physics and (b) Meteorology and Oceanography.

4. Geology includes (a) Applied Geology, (b) Geo-Physics, and (c) Physics of the Earth.

The overall increase in the output of postgraduates in basic sciences has been 120.6 per cent during 1950-55, 83.6 per cent during 1955-60 and 48.2 per cent during 1960-63. The detailed subject-wise break-up is given below

Subject	Percentage increase over five-year periods		
	1950-55	1955-60	1961-63
Chemistry	96.5	91.4	39.9
Physics	84.0	78.8	44.9
Mathematics	261.2	57.2	59.2
Botany	185.4	78.6	51.2
Zoology	100.6	80.1	49.3
Geology	31.3	217.9	56.6
ALL THE ABOVE SUBJECTS . .	120.6%	83.6%	48.2%

Source. Basic Facts and Figures, University Grants Commission.

distinguished teachers of our university spend a part of their time (say, a couple of months in a year) at other universities interested in their line of speciality. We understand that the UGC has a scheme for exchange of teachers. We recommend that the scheme be enlarged in scope and an adequate financial support given to it.

16.23 We have in an earlier chapter¹⁸⁹ expressed our strong support of the concept and scheme of the Centres of Advanced Study. In this programme valuable assistance has been provided by the USSR through UNESCO. Some of the Centres have made commendable progress, but there are many where we are not wholly satisfied by the progress made so far. We understand that this matter is under special review by the UGC. If the Centres of Advanced Study are to fulfil their role in setting standards of teaching and research, and in the training of future teachers, it is essential that the level of the academic staff at the Centres is of the highest quality. It should, wherever possible, include some persons of international standing to provide inspiration and leadership. It will be most desirable to provide a number of visiting professorships on contract appointments for a period of two to three years. It may be a distinct advantage to have an all-India Committee constituted by the UGC to make offers of visiting professorships. Under this scheme we could invite some of the internationally famous Indian scientists at present working abroad as well as distinguished foreign scientists. Their pay scales and other conditions of service, including provision of residential accommodation, will have to be fixed at a suitable level. The professors under the scheme would be assigned to universities in consultation with

¹⁸⁹ Chapter XI.

them. To begin with, the number of such visiting professors could be limited to about fifty in all science subjects including mathematics.

16.24 *Regional Imbalances in Science Education.* In the context of expansion of science education it is important to draw attention to the wide variation as regards facilities amongst the different States in the country. In this connection, attention is invited to Table 16.3 and the chart on page 553. It will be seen therefrom that the enrolment in science courses, expressed per unit of the total population is the highest in the southern States. The lowest is in the State of Rajasthan: it is about 500 per million of the population as compared to the highest figure of 2,200 per million in Kerala. This regional imbalance in science education and even more so in technology is a matter of serious concern. It has a direct effect on the pace of industrial development. Deliberate efforts should be made to raise the enrolments in science and technology in States in which it is at present substantially below the all-India average. Also, it is important that there is an adequate matching between the industrial and agricultural development and potential of a region on the one hand and the availability of facilities for education in science, technology and agriculture on the other. The universities can and should play an increasingly significant role in the general development of the region in which they are located; and this is particularly important for universities situated in the less developed parts of the country. By suitably orienting their courses of study specially in science and technology, by a careful selection of research projects, and by adequate stress on field studies and extension work, the universities can exert a powerful impact on the economic and cultural development of the regions in their neighbourhood and of the country generally.

16.25 *Curriculum Reform.* There is an urgent need, in general, of revising drastically the undergraduate and postgraduate curricula. The UGC has brought out reports of its Review Committees in mathematics and other science subjects which give an account of the courses provided by the universities, and make specific recommendations for the improvement of curricula. The Reports deal also with university research. The recent UNESCO studies, such as *A Survey of the Teaching of Physics at Universities* (1965), prepared under the auspices of the International Union of Pure and Applied Physics, provide valuable information about the level and contents of university courses in some of the scientifically advanced countries.

16.26 We would like to stress the extreme importance of field work and environmental studies in biological and earth sciences. The study of natural and semi-natural plant population deserves special attention. It

is relevant to the breeding of new crops resistant to plant diseases and climatic extremes. A foreign botanist who recently visited our universities, while expressing satisfaction that many students were studying botany, remarked that 'most of the subject matter they learn in the university botany courses is absolutely useless to them'. Industrial and agricultural applications of science subjects should be clearly and forcefully brought out and illustrated in terms of local industries and experience accessible to students. A frequent criticism of geological education in our country relates to lack of adequate field training. The earth materials, processes and historical events should be observed in their natural associations and in the field. Adequate time should be devoted to field training in an intensive way; and it should cover experience with the greatest possible variety of geological materials and phenomena. Field training should be continuous over a period of at least two months in a year. It would be an advantage to link field training, wherever possible, with work and programmes of the National Geological Survey. That would make the training realistic and useful. As regards museum collections, there is usually a good set of foreign specimens but relatively little of Indian collection. Indian specimens could be readily prepared on the basis of an exchange service operating between our geology departments. Topographic and geologic maps of typical areas in India are also not generally available in most departments. Again, subjects like geochemistry, geophysics and geomagnetism and economic geology are of great importance in the exploitation of the natural resources and should be emphasized in the training of geologists. In the field of biology, the study of micro-organisms and their role in medicine and agriculture deserves much more attention than is generally the case. Universities and colleges should make full educational use of museums, public botanical gardens and zoos and scientific and industrial institutions.

16.27 It is important that in our physical science departments a proper balance between experimental and theoretical aspects is maintained. For instance, it is quite common for physics departments to do a lot of theoretical work without any reference to or contact with experimental work in the same field. Special and urgent attention should be paid to the development of experimental physics and chemistry. In the field of chemistry studies in areas such as synthetic chemicals, fertilizers, pesticides, chemistry of natural products, petro-chemicals and synthetic fibres, pharmaceuticals and dyestuffs should be more practical-based and in close relation to industry. Astronomy and astrophysics also deserve special attention and support in view of current developments of far-reaching importance. India's contribution in this field has been outstanding. The name of M. N. Saha immediately comes to mind.

TABLE 16.3 UNIVERSITY ENROLMENT IN INDIA: STATE-WISE AND FACULTY-WISE (1964-65)

State	Arts	Science	Commerce	Education	Engg-tech	Medicine	Agriculture	Vet. Sc.	Law	Others	Total
Andhra	. . . 18,181 (23.1)	37,083 (47.1)	5,526 (7.0)	1,487 (1.9)	6,169 (7.8)	6,915 (8.8)	1,181 (1.5)	626 (0.8)	1,291 (1.6)	312 (0.4)	78,691 ..
Assam	. . . 32,667 (67.9)	9,464 (19.6)	2,367 (4.9)	391 (0.8)	967 (2.0)	1,117 (2.4)	391 (0.8)	246 (0.5)	527 (1.1)	.. ..	43,197 ..
Bihar	. . . 61,253 (53.8)	31,670 (27.8)	5,774 (5.1)	1,042 (0.9)	6,632 (5.8)	2,941 (2.6)	1,089 (0.9)	650 (0.6)	2,846 (2.5)	6 ..	1,13,903 ..
Gujarat	. . . 30,966 (37.0)	24,289 (29.0)	12,329 (14.7)	1,148 (1.4)	6,019 (7.2)	3,686 (4.4)	1,241 (1.5)	100 (0.1)	3,319 (3.9)	690 (0.3)	83,787 ..
Jammu & Kashmir	. . . 5,176 (39.7)	5,237 (40.2)	235 (1.8)	420 (3.2)	971 (7.5)	650 (5.0)	334 (2.6)	.. ..	.. ..	.. ..	13,023 ..
Kerala	. . . 28,632 (34.3)	40,978 (49.1)	3,590 (4.3)	2,450 (2.9)	4,008 (4.8)	2,734 (3.3)	284 (0.4)	252 (0.3)	524 (0.6)	.. ..	83,452 ..
Madhya Pradesh	. . . 36,696 (41.0)	23,226 (26.0)	10,833 (12.1)	2,326 (2.6)	6,062 (6.8)	4,202 (4.7)	1,356 (2.1)	492 (0.6)	312 (3.5)	420 (0.5)	89,264 ..
Madras	. . . 23,002 (26.1)	41,673 (47.2)	5,697 (6.4)	1,828 (2.1)	6,580 (7.5)	6,013 (6.8)	988 (1.1)	705 (0.8)	1,161 (1.3)	631 (0.7)	88,278 ..
Maharashtra	. . . 59,363 (35.7)	51,632 (31.1)	29,519 (17.7)	3,725 (2.2)	5,781 (3.5)	6,844 (4.1)	3,909 (2.4)	361 (0.2)	5,050 (3.0)	100 (0.1)	1,66,334 ..
Mysore	. . . 16,703 (23.3)	29,855 (41.7)	6,058 (8.5)	1,371 (1.9)	8,340 (11.6)	6,040 (8.4)	967 (1.3)	437 (0.6)	1,905 (2.7)	.. ..	71,676 ..

Orissa	.	.	11,826 (43.5)	8,625 (31.7)	786 (2.9)	611 (2.2)	1,856 (6.8)	1,841 (6.8)	970 (3.6)	259 (1.0)	428 (1.5)	.	27,202 ..
Punjab	.	.	39,900 (50.0)	17,749 (22.2)	1,581 (2.0)	4,069 (5.1)	7,884 (9.9)	4,832 (6.1)	2,023 (2.5)	386 (0.5)	983 (1.2)	423 (0.5)	79,830 ..
Rajasthan	.	.	16,614 (40.9)	9,898 (24.4)	6,656 (16.5)	1,425 (3.5)	1,434 (3.5)	1,911 (4.7)	1,372 (3.4)	180 (0.4)	1,101 (2.7)	..	40,591 ..
Uttar Pradesh	.	.	1,51,335 (45.3)	1,01,219 (30.3)	24,332 (7.3)	4,710 (1.4)	7,560 (2.3)	5,596 (1.7)	27,029 (8.1)	864 (0.3)	5,230 (1.5)	6,247 (1.8)	3,34,122 ..
West Bengal	.	.	88,309 (49.2)	42,906 (23.2)	30,017 (16.8)	2,284 (1.3)	6,843 (3.8)	4,199 (2.3)	594 (0.3)	153 (0.1)	3,778 (2.1)	363 (0.2)	1,79,446 ..
Delhi	.	.	20,536 (67.6)	3,229 (10.6)	2,489 (8.2)	241 (0.8)	1,008 (3.3)	2,161 (7.1)	..	..	705 (2.3)	35 (0.1)	30,431 ..
TOTAL	.	.	6,41,186 (42.0)	4,78,702 (31.3)	1,47,789 (9.7)	29,528 (1.9)	78,114 (5.1)	61,742 (4.0)	44,228 (2.9)	5,711 (0.4)	32,000 (2.1)	9,227 (0.6)	15,28,227 ..

Including enrolment in Intermediate Boards.

Source. *University Development in India*, University Grants Commission. (These enrolments will not tally with those given in Chapter XII because of the different basis adopted.)

16.28 *Workshops in Science Departments.* There should be well-equipped workshops in every college and university department of science. Students should be encouraged to learn the use of workshop tools and get acquainted with some of the essential laboratory techniques and practices, e.g., glass-blowing, metal work, carpentry, coil winding, photographic techniques and making of projection slides, soldering and welding, electrical circuitry and wiring, and general maintenance and repair of mechanical and electrical equipment used in laboratories. This training would be specially useful to those of them who become teachers. It will help them to carry out ordinary laboratory repairs and to improvise and fabricate simple apparatus. The workshops should work far more intensively than is usually the case. It would be desirable to permit their use by industrial workers enrolled for evening and correspondence courses.

16.29 *Practical Work.* In connection with experimental work of undergraduate and postgraduate students, special attention needs to be paid to improve the quality of practical work and to integrate it with the learning of theory. It would be of good value to provide, specially at the postgraduate stage, a short course in basic laboratory techniques and workshop practice. A certificate of workshop training could be issued to students who reach a certain level of proficiency. Students in all science subjects should have some knowledge of the theory of errors, basic statistical concepts and statistical design of experiments. It is widely felt that terminal practical examinations as generally conducted hardly serve any useful purpose. These should be dispensed with and replaced by assessment of the students' performance in the laboratory throughout the academic year. The evaluation should be completed every term by the teacher in charge of practicals: and a satisfactory performance should be an essential requirement for taking the terminal (written) examinations.

16.30 *Interdisciplinary Studies.* As pointed out earlier in Chapter XII, there is an urgent need to introduce an element of flexibility and innovation in the organization of our courses for the Master's degree because several border-line and interdisciplinary subjects are rapidly developing as areas of major study and research. In this context, and also apart from it, it would be useful to provide, in addition to our present 'one subject' M.Sc. courses, *combination courses* consisting of, say, one major subject and one subsidiary or contextual subject. For instance, combination courses in mathematics and physics, chemistry and geology, life sciences and physics, mathematics and economics, would be of great value and interest. Such courses should be organized jointly by the departments concerned. It is important to break the prevailing rigidity and deadening

uniformity, as also the barriers between departments within the same university.

16.31 It will be a great advantage if major departments in life sciences have on their academic staff a small number of physical scientists (including mathematicians) specially selected for their interest in the study of biological phenomena. The physical scientists could be on deputation from their parent departments; and there could be also joint appointments between two departments. Similarly, selected members from departments of life sciences could be on deputation to departments of physical sciences. Again, science departments, specially physics and mathematics, will benefit immensely by close association with engineers with research interests. A course, say, in electricity and magnetism, electronics or material science, if given jointly by physicists and engineers can be most stimulating and effective. The need of the day is to bring science and technology closer together in our educational system. As J. A. Stratton (former President of the MIT, Boston) has observed, 'there could be no greater disservice to the cause of science and engineering than to set one against the other' and thus cause a cleavage between the two.

16.32 *Special Courses.* Apart from the regular two-year M.Sc. courses there is need to provide one-year courses, or of even shorter period, for specialized training in subjects relevant to present scientific, industrial and other needs. These courses could be provided by selected science and technology departments in universities, engineering and agricultural institutions or the National Laboratories. An illustrative list of such courses is given in Table 16.4.

16.33 The admission qualifications for these courses would be B.Sc. M.Sc., or first degree in engineering depending on the course. Those who successfully complete a course would be awarded a certificate (if the course is of a few months) or a diploma. Some of the courses may be suitable for a B. Phil. degree described below.

16.34 *Part-time Education in Science Subjects.* As one of the important steps towards linking education with practical life, it would be desirable for universities and engineering institutions to enrol qualified industrial workers for part-time education in science and technology through evening (or early morning) classes and correspondence courses. Apart from the usual diploma and degree courses, special certificate courses to train precision mechanics, laboratory technicians and other skilled operators could be organized. There is a considerable shortage at present of laboratory mechanics and middle-level technicians.

TABLE 16.4 ILLUSTRATIVE LIST OF RECOMMENDED SPECIAL COURSES

Initial qualification B.Sc. degree	Initial qualification M.Sc. or B.E. degree
Agricultural Chemicals	Quantum Electronics
Antibiotics	Analytical Chemical Techniques
Bacteriology	Applied Mechanics
Biochemical Techniques	Biophysics
Electrochemistry	Coherent Radiation
Electronics	Computer Technology
Elementary Applied Optics	Dyestuff Technology
	Electron Microscopy
Fisheries	Experimental Psychology
Forests & Forest Products	Geochemical Techniques
Genetics	Geophysical Prospecting
Insect & Pest Control	Health Physics
Instrumentation (General)	High Polymers
Isotope Techniques	History of Science
Laboratory Techniques (General)	Nutrition
Metallurgy	Operational Research
Mineral Prospecting	Petrochemistry
Plant Breeding	Environmental Sanitation
Plastics	Radiation Biology
Refrigeration	Rocket Technology
	Seismic Studies
	Soil Physics
	Materials Science
	Semi-conductors
	Thermodynamics of Irreversible Processes

16.35 *A New Academic Degree.* There is a need, in view of the rapid increase of scientific knowledge and development of border-line subjects, for the introduction of a new degree beyond the M.Sc. stage.²⁰⁰ This, unlike the Ph.D., would be essentially a degree by examination, though it may include a short dissertation in lieu of a written paper. The course could include with advantage, on an optional basis, elements of pedagogy. The normal period for taking the degree would be two years, but in special cases exemption of a year may be granted. The degree may be called B.Phil as at Oxford (or M. Phil as at Yale). This degree should not be regarded as a necessary requirement for proceeding to the Ph.D., though in some cases it would certainly be an advantage to take this degree first. It may be possible for some departments which are unable to provide work up to the Ph.D. level to enrol students for the B.Phil. It could be amongst other things a useful training for would-be teachers. It would also facilitate movement of research students from one university to another, completing B. Phil at one place and D.Phil. at another institution.

16.36 Before we proceed to discuss problems of university research we would like to refer briefly to the programme of summer science institutes and one or two other items of general interest.

²⁰⁰ What is said here can also apply, *mutatis mutandis*, to degrees in the social sciences.

16.37 *Summer Science Institutes.* A programme specially designed for the improvement of science education at the secondary school and undergraduate levels relates to the organization of the summer science institutes initiated in 1963 by the University Grants Commission and the National Council of Educational Research and Training with the support of the USAID and the National Science Foundation (USA). The programme is directed towards the activation and improvement of the subject-matter competence and scientific background of teachers of schools and colleges. The number of science institutes has increased from four in 1963 to more than eighty in 1966. About 6,500 school teachers and 3,500 college teachers have so far attended the institutes. A striking feature of the summer institutes is that it brings together in active participation school and college teachers, and leading university professors. The programme of summer institutes is a major instrument in the country's effort towards the improvement of science education in schools and colleges. The UGC and the NCERT have under consideration an extensive follow-up programme of the summer institutes with the support of the US National Science Foundation.

16.38 *Books in Science.* It is unfortunate that most of the quality books in science and technology even at the undergraduate stage are still very largely imported. All imported books are not quality books. A large-scale import of textbooks in science and technology is not only expensive and costs foreign exchange, but it is bad for our intellectual morale. The country has the talent and other resources required to produce first-rate books, but it appears that what is lacking is determination and planned effort. The Inter-University Board and the UGC should take a lead in the matter so that by the end of the Fourth Plan most of the books required at the undergraduate level and a considerable number at the postgraduate level are produced within the country. It is important that learned and professional societies in the country lend active support and encouragement to the preparation of outstanding books and monographs, and give high professional recognition to such work—it should enjoy a status accorded usually to research.

16.39 *Scientific Terminology.* In this context a reference may be made to scientific and technical terminology in the Indian languages. Such a terminology is necessary for the writing of science material and textbooks in these languages. The Ministry of Education appointed, about five years ago, a Standing Commission on Scientific and Technical Terminology. The Commission works in close association with the universities and professional bodies concerned with scientific termino-

logy. It has published standard glossaries in Hindi of scientific terms required at the school stage. In some science subjects glossaries have also been published for use at the first degree level. The Commission has followed the sound and practical codes of adopting in Hindi and other regional languages the current English forms of international terms, e.g., names of units, chemical elements and compounds, as also mathematical signs and symbols. Scientific and technical terms which stand for concepts are translated into Hindi and other Indian languages, every attempt being made to have the same word in different languages. What the Commission has recommended and done in relation to Indian languages is in accordance with the standard practice in almost all countries. The present international terminology relates largely to chemical compounds and medical terms. The vocabulary is mainly based on a thousand Greek and Latin roots. For students of science, specially medicine, it is a great advantage to learn a couple of hundred frequently used Greek and Latin roots which serve as bricks for word building in science. We suggest that this should be made a part of the curriculum. L. Hogben writes (*The Mother Tongue*, London 1964): 'To use his emotionally neutral language of science intelligently, and to add to its stock-in-trade, we do not need to be proficient in Greek or in Latin; but we do need to know a few hundred current roots derived from Greek words and a few hundred from Latin words with the meaning they now have by general consent in current speech. Unless we have such knowledge, we shall miss useful clues to meaning and we shall adopt or coin meaningless new words.'

SCIENTIFIC RESEARCH

16.40 *Scientific Research and National Prosperity.* In the modern world, scientific research constitutes a fundamental activity of a nation, vital to its progress, intellectual morale and well-being. The close interaction between expenditure on research and development and the level of *per capita* GNP is apparent from a glance at Tables 16.5 and 16.6. The figures for consumption of commercially produced energy per head of population provide a useful index of industrial development. Education and research are not only the fruits but also the seeds of industrial development.

The current level of expenditure on research and development in India is about one rupee *per capita*, nearly 0.3 per cent of the GNP. It will be seen that India is almost at the bottom end of the 'international ladder' of R and D effort expressed as a percentage of the GNP. This will be seen in the chart on page 725. In making comparisons between highly industrialized and under-industrialized countries, it should be

TABLE 16.5 EXPENDITURE ON RESEARCH AND DEVELOPMENT AND GNP (1960)

Country	Expenditure on research and development (1960)		Consumption of commodities specially produced energy per capita (1960) (tons equivalent coal)	GNP Dollars per capita
	Percent of GNP	Dollars per capita		
U.S.A.	2.8	78.4	8.0	2308.0
U.S.S.R.	2.3	36.4	2.9	..
U.K. (1961)	2.7	35.4	4.9	1146.0
France	2.1	27.0	2.5	1026.0
Sweden	1.6	27.0	3.5	..
Canada	1.2	21.9	5.6	1408.0
W. Germany	1.6	20.0	3.6	1115.0
Switzerland	1.3	20.0	1.9	1463.0
Netherlands	1.4	13.5	2.8	859.0
Norway	0.7	10.0	2.7	..
Luxembourg	0.7	9.3	..	..
New Zealand	0.6	8.9	2.0	1317.0
Belgium	0.5	7.5	4.1	1030.0
Japan	1.6	6.2	1.3	404.0
Hungary	1.2	..	2.5	..
Poland	0.9	5.3	3.2	..
Australia	0.6	5.3	2.2	1239.0
Italy	0.3	1.8	1.2	623.0
Yugoslavia	0.7	1.4	0.9	223.0
China	..	0.6	0.6	..
Ghana	0.2	0.4	0.1	198.0
Lebanon	0.1	0.3	0.7	..
Egypt	..	0.3	0.3	138.0
Philippines	0.1	0.3	0.2	200.0
India	0.1	0.1	0.1	69.0
Pakistan	0.1	0.1	0.1	54.0

Source. Taken from *Underdeveloped Science in Underdeveloped Countries*, Stevan Dedijer, Minerva, Autumn, 1963.

remembered that, in poor countries, the GNP is not much beyond the level of bare subsistence; and the 'surplus' left after meeting the minimum needs of the people for food, clothing and shelter is a very small portion of the total GNP.

16.41 *Investment in Research.* In an age characterized by science and technology research is almost a necessary precondition for all kinds of human endeavour. In the industrially advanced countries the growth of investment in research and development, and of manpower engaged in these activities, has surpassed all expectations. This will be seen from Table 16.6.

TABLE 16.6 ESTIMATED GROSS EXPENDITURE ON RESEARCH AND DEVELOPMENT (GERD) AND GROSS NATIONAL PRODUCT (GNP), 1962

	United States	Western Europe*	Belgium	France	FR Germany	Netherlands	United Kingdom
GERD in National Currency (millions) .	17,531	..	6,625	.430	4,419	860	634
GERD in \$ US (millions official exchange rate)	17,531	4,360	133	1,108	1,105	239	1,775
GNP at market price† in national currency (millions) . . .	557,590	..	646,200	356,300	354,500	48,090	28,560
GERD as % of GNP at market price	3.1	..	1.0	1.5	1.3	1.8	2.2
Population (millions)	187	176	9	47	55	12	5
R and D expenditure per capita (in \$ U.S.).	93.7	24.8	14.8	23.6	20.1	20.3	35.5

* Belgium, France, Germany, Netherlands, United Kingdom.

† If GNP is taken at factor cost instead of market price, the ratios are as follows:

United States	. . . . .	3.5%
Belgium	. . . . .	1.2%
France	. . . . .	1.8%
Germany	. . . . .	1.5%
Netherlands	. . . . .	1.7%
United Kingdom	. . . . .	2.5%

Source. *The OECD Observer* Special issue on Science, February, 1966, p. 11.

The total expenditure on research and development is between about 1 to 3 per cent of the GNP. It may also be pointed out that in some of the countries the research and development expenditure has increased nearly

four-fold over the past decade. France spent 1.8 per cent of the GNP on research and development in 1962 and it is expected to go up to 2.5 per cent by 1970. Also, over the same period the number of people employed in scientific work and higher education is likely to be doubled. Such high rates of growth cannot obviously be sustained indefinitely. For example, in the USA during the last two years there has been a considerable slowing down of the R and D growth rate, but it is not certain whether it is only a temporary phase or an indication of an approach towards a state of equilibrium (saturation stage). Even highly industrialized countries will find it extremely difficult to provide for research and development a figure exceeding about 5 to 10 per cent of the GNP.

16.42 Recently there has appeared a most valuable study on the measurement of research and development effort in Western Europe, North America and the USSR (by C. Freeman and A. Young, OEC D, Paris, 1965). A particularly significant feature of the Freeman-Young study is an attempt to estimate what they call a 'research exchange rate'. In the usual comparison of research and development expenditure in different countries, no account is taken of the fact that a given amount of money in one country does not generate the same research and development effort as in another country. In other words the *official exchange rate* is likely to differ markedly from what may be called the *research exchange rate*. Freeman and Young are unable, on the basis of available data, to provide precise figures, but as a tentative estimate the ratio of the American to the European research and development costs is about 1.5 to 2. The American costs as compared to the USSR are nearly three times as high.

16.43 It is interesting to observe that (in 1962, the year to which the study relates), about 60 per cent of the total R and D expenditure by the USA was for military and space research. The corresponding figure for the UK was about 40 per cent, for West Germany 10 per cent, and still lower for Belgium and the Netherlands.

16.44 We reproduce two tables from the *Freeman-Young Report* (Tables 16.7 and 16.8). These provide valuable insight into the structure and organization of research and development and underscore the connection between the percentage of the national income spent on research and development and the number of scientists and technologists expressed as a percentage of the total population. If one of them is high and the other low it cannot but lead to inefficiency and wastage. To have more science we need more scientists. Investment on research and education are inseparable. For instance, in 1920, the total US expenditure on research and development was 0.1 per cent of the GNP; it rose to

0.5 per cent by 1940. The current figure exceeds 3 per cent. The total number of professionally qualified scientists and engineers (engaged in all types of activities including R. & D) was about 0.6 per cent of the total labour force in 1940; the current figure is about 1.5 per cent and is expected to go up to 2 per cent by 1970. The Indian expenditure on R and D is 0.3 per cent of the GNP; and the total strength of scientists and engineers is only a few hundredths of one per cent of the labour force. (The number of qualified scientists and engineers is of the order of a hundred thousand.)

TABLE 16.7. ESTIMATED GROSS EXPENDITURE ON RESEARCH AND DEVELOPMENT BY SECTORS OF ECONOMY (1962)
(in percentages)

	Performance			Source of funds		
	Business enterprises	Higher education	Government and non-profit	Business enterprises	Higher education	Government and non-profit
United States . . .	71	10	19	35	2	63
Western Europe . . .	59	12	29	43	..	57
Belgium	65	13	22	63	..	37
France	48	14	38	30	..	70
West Germany . . .	61	20	19	60	..	40
The Netherlands . .	60	14	26	65	..	35
United Kingdom . .	63	5	32	36	..	64

UNIVERSITY RESEARCH IN SCIENCE

16.45 We shall now turn to university research in science. It is unfortunate that we have less information about some essential aspects of university research than about almost any other major aspect of education. This lack of information is perhaps both a cause and an effect of the relative neglect of university research within the framework of the nation's research activities and education. We would like to stress that within the UGC organization an important place should be given to a continuous production of objective information, by the most advanced methods available, on university research in India and its impact on Indian society. Further, as science in its essential aspects is universal and supranational, in the formulation of a national research policy and its relation to educational policy it is important to make a systematic study

TABLE 16.8 ESTIMATED MANPOWER ENGAGED ON RESEARCH AND DEVELOPMENT (1962)

	Scientists and engineers engaged on R and D	Other personnel engaged on R and D	Total personnel engaged on R and D	Total population	Total working population (aged 15-64)	R & D personnel per 1,000 population	R & D personnel per 1,000 working population
	Thousand full- time equivalent	Thousand	Thousand	Million	Million		
United States	•	•	•	•	•	•	•
USSR	(1)	435.6	723.9	1,159.5	186.6	111.2	6.2
(2)	416.0*	623.0	1,039.0	220.0	142.0	4.7	7.3
	(487.0)	(985.0)	(1,472.0)			(6.7)	(10.4)
Western Europe	•	•	•	•	•	•	•
	147.5	370.8	518.3	176.1	113.9	2.9	4.6
Belgium	•	•	•	•	•	•	•
	8.1	12.9	21.9	9.2	6.0	2.3	3.5
France	•	•	•	•	•	•	•
	28.0	83.2	111.2	47.0	29.1	2.4	3.8
Germany	•	•	•	•	•	•	•
	40.1	102.1	142.2	54.7	56.7	2.6	3.9
The Netherlands	•	•	•	•	•	•	•
	12.6	20.2	32.8	11.8	7.5	2.8	4.5
UK	•	•	•	•	•	•	•
	58.7	152.4	211.1	53.4	34.8	4.0	6.1

* (1) 'Conservative' estimates; (2) including 'project' assumptions.

N.B. The population between the ages of 15 and 64 is a sector *capable* of doing productive work, but, of course, a large proportion is not actually working in this sense.

and comparison with developments in other countries, and more significantly in the USSR, the USA, Japan, and the People's Republic of China.

16.46 A major weakness of Indian education and research is the relatively very small part played by the universities in the sum total of Indian research which itself is far smaller than what it should be in relation to our capabilities and needs. Before Independence there was little provision for and little attention paid to research in the universities. The Government took little serious interest and provided hardly any encouragement even to the most outstanding of the scientists. In spite of all these difficulties some of the Indian contributions have been in the forefront of world science; but this serves only to highlight the general paucity and lack of research atmosphere in the universities. A stage has now been reached when deliberate support and encouragement of advanced study and research in the universities should become a fundamental goal of our national policy. This is central to the entire progress and development of science in the country.

16.47 *Research Function of Universities.* The research function of universities has many important aspects, and it has a powerful impact on the entire national life. Some major aspects can be summarized as follows:

- (1) *Production of Researchers.* The university is the central place for the identification of research talent. It produces all or very nearly all the researchers of the country. It gives them basic training in research. Thus, the quality of national research depends to a very large extent on the quality of university research.
- (2) *Performance of Research.* The universities in educationally advanced countries (but not in India today) do a very considerable portion of national research work, both in quantity and variety. The top leaders of science of a country are generally in the universities or work in the closest association with them.
- (3) *Quality of Teaching.* Engagement in research work is a major pre-condition for creative teaching and stimulation of creativity.
- (4) *Production of Teachers.* Since the universities produce their future teachers, and also for secondary schools, a developed research atmosphere in the universities has a direct bearing on the entire character and quality of teachers, and through them it influences the identification and development of their pupils.
- (5) *Training of Leaders.* Leaders and decision-makers in nearly all fields of national life are now almost exclusively university trained. A major task of the universities is to impart to the country's future leaders an interest in the development of a

scientific attitude in tackling the problems they are called upon to face in their work.

- (6) *Consultative Function.* Through its research function, the university staff can and does provide advisory and consultative services to other institutions engaged in research, production, decision-making, etc. This should be vigorously encouraged in our country.
- (7) *Research Policy.* In most countries it is the universities which supply the majority of advisory personnel for research policy bodies, including committees advising at the highest level of government.
- (8) *Scientific Tradition.* The university staff play a key role in the development and improvement of the scientific tradition of the country, and in the organization and development of a socially aware and active scientific community. The university staff perform this function through their contacts and communication with each other, and with scientists outside the university. Through individual contacts and through student societies the teachers help to develop scientific tradition and proper norms of behaviour in the students—the scientific community of the future. Scientific societies of staff and students in university departments and colleges play an important role in promoting research interest and creativity in the youth.
- (9) *International Contacts.* The academic bodies at a national level consisting largely of university scientists play a major role in promoting international contacts and understanding which often extend beyond the domain of science.
- (10) *Government and Universities.* A healthy relationship between university and the Government is of vital importance in ensuring a balanced and fruitful interaction between Government and science generally.

16.48 The creative scientists and engineers of a country are one of its most precious and also scarce assets. These should be so developed as to generate a maximum 'multiplier effect'. The 'multiplier effect' of a top ranking scientist is generally maximum in a university: working in a university he contributes not only to scientific research but also to the building up of new talent—he serves as the focal point of inspiration and 'growing point' of young creative scientists. It is important that more and more university people—that is *teachers and students*—should perform more and more research work and of a better and still better quality. As an ultimate goal every university teacher in India should become a researcher and every university researcher should become a teacher. Publication of quality research apart from good teaching

ability, should become one of the basic criteria for advancement of teachers in their university career. Gifted students even at the undergraduate stage should be encouraged to participate in some form of research activity including field and project work and operational research type studies—special arrangements for the purpose could be made during vacations. A certain proportion of the bright M.Sc. and Ph.D. students should spend also a portion of their time in teaching work, including participation in formal courses to undergraduate and postgraduate students. Also, wherever practicable, active scientists in the CSIR, AEC and other research institutions outside the university system should be invited and induced to participate in teaching and research work full-time or part-time, for short or long periods. Teaching stimulates research and creativity. It is a most fruitful and rewarding experience.

16.49 *Academic Mobility.* In the field of science at the postgraduate and research levels, we attach considerable importance to mobility of students (and also teachers) between universities as well as between universities and National Laboratories and other research institutions in the country. We recommend that it should be made possible for selected postgraduate students to spend during their course work a term or two in another university or institution specializing in the subject of their interest. These students should be awarded grants to cover their expenses. Further, the UGC scheme of assisting teachers, research workers, and laboratory technicians to visit universities and research institutions for short periods (a few weeks to a few months) should be considerably expanded. The scheme is important not only for the professional advancement of the staff, but also for promoting cooperation between universities and research institutions.

16.50 *Team-work.* The development of team-work is an essential condition for the improvement of the quality of university research. It is also a necessary condition for the development of a healthy research atmosphere and research community within the departments and within the university system as a whole. Team-work must be real. It is a travesty of team-work and the spirit of research if the professor or the departmental head puts his name on every paper without his having contributed anything to the solution of the research problem. Unfortunately, this is not a rare thing in India. It should be a part of university research policy to eliminate ruthlessly such spurious and parasitic 'team-work'. Further, there should be placed a limit on the number of research students under the supervision of the head of a department or any other teacher. Research students in a department should not be

all assigned necessarily to the head of the department or to professors only. Younger members of the staff, if otherwise qualified, should be encouraged and given facilities to guide and supervise research.

16.51 *Qualifications for Ph.D. Enrolments.* The qualifications for Ph.D. enrolment also need to be much more broad-based and flexible than is generally the case. It should be made possible for an M.Sc. in a particular discipline to enrol for his doctoral work in a department belonging to another discipline or faculty, subject to the approval of the head of the department concerned. This will help the development of interdisciplinary areas. We should also encourage research-minded engineering graduates to go in directly for Ph.D. in mathematics, physics and other science subjects—in such cases a postgraduate degree should not be insisted upon as an essential requirement for proceeding to Ph.D. work. This will help in attracting more persons to engineering and technological research.

16.52 *Role of Mathematics.* As pointed out earlier, it is almost inevitable that the gap between the scientific work in a developing country and in an advanced country is large, but usually it is very much bigger in some parts of the spectrum than in others. However, if a developing country is to put forth its best effort, and to sustain it over a long period of time, it must seek some areas of scientific enterprise where it can expect to stretch itself to the utmost and do something of world significance. Identification of such areas is not easy. It demands great insight, courage and imagination, but it is essential to the whole morale of a nation's scientific endeavour. In this context a field of study which immediately comes to mind is mathematics.

16.53 We cannot over-stress the importance of mathematics in relation to science, education and research. This has always been so but at no time has the significance of mathematics been greater than today. The new revolution in science based on cybernetics and automation which is likely to be in full swing by the end of the century, may have an impact on men even greater than anything that has happened so far in human history. The cybernetic revolution would give a new importance and role to mathematics. For these and other reasons, it is important that deliberate effort is made to place India on the 'world map of mathematics' within the next two decades or so. Advanced centres of study in mathematics should be established at three or four universities in the next five to ten years. An obvious place for one such centre, we think, is the University of Madras and the Ramanujan Institute of Mathematics.

16.54 We would also recommend that at least one of the major

departments of mathematics in the universities is encouraged to take an active interest in exploring the possibilities of *programmed learning* in mathematics for upgrading the knowledge and understanding of school and college teachers. In this field we could use with great profit programmed texts produced abroad, especially in the USA.

16.55 As an experimental project of great value and potentiality for the growth of mathematics in the country we suggest that one or two special secondary schools for pupils with unusual mathematical ability be set up in the near future. It would be a residential school, teaching mathematics as also other allied subjects and attached to a university with front-rank departments in mathematics and physical sciences. Here gifted young students would come in close contact with and be taught by university professors. This would give them a most stimulating and inspiring experience and promote actively the unfolding of their creative abilities.

16.56 We have suggested mathematics not only because of its intrinsic importance, but also as it is relatively easier to identify young talent in mathematics than in other fields. It is generally admitted that there is no significant correlation between creativity and high examination scores. Recently Sir John Cockcroft has thus summarized the influences which are important in the development of the creative scientists.

A childhood environment in which knowledge and intellectual effort are so highly valued for themselves that an addiction to reading and study is firmly established at an early age.

An unusual degree of independence which, amongst other things, leads to discovering early that a student can satisfy his curiosity by personal efforts.

An early dependence on personal resources and on the necessity to think for himself.

An intensive drive that generates concentration and persistent, time-ignoring effort in his studies and work.

A secondary school training that tends to emphasize science rather than humanities.

High, but not necessarily remarkably high, intelligence.²⁰¹

16.57 *Computer Technology*. A special effort should be made by the UGC to provide computation installations and training in programming on a selective basis in the universities. By the end of the Fourth Plan a good proportion of the universities should have basic computer facilities to serve the requirements of study and research in science, mathematics and social sciences. Whereas general purpose computers should be widely available, sophisticated machines should be used on

²⁰¹ *The School Science Review*, 1966, p. 291.

an inter-institutional collaboration basis. We suggest that the UGC appoint an expert committee to work out a ten-year programme for the supply of computers to universities. The possibility of setting up an advanced centre in this field for the study of computation theory, mathematical logic and numerical analysis may be examined by the UGC.

Incidentally, it may be mentioned that the USA in 1964 had about 15,000 electronic computers (equivalent IBM 7090), and the number is increasing at the rate of 25 per cent per year. Some 1.5% of these cost more than \$750,000 each. The UK in 1964 had some 1,000 computers. **As for India, the number is less than fifty.**

16.58 The recent advances in electronics, as also developments in the fundamental theory and design of computers, have given a new impetus to the study of the mechanism of the brain and related problems. It would be desirable to support energetically and develop one or two active centres for the study of brain and psychosomatic phenomena, using modern techniques and also drawing upon past Indian experience in this field which even today in some ways is of great significance.

16.59 *Equipment.* Scientific research is becoming increasingly complex, expensive and sophisticated, and it makes increasingly new demands on specialized, elaborate and costly equipment and instruments. As an illustration, let us take the case of chemical research. In our country, there is hardly any university laboratory of chemistry which is equipped with mass-spectrographs, digital computers, nuclear magnetic resonance apparatus (NMR), and so on; yet in advanced countries these types of instruments are in common use in chemical research. A recent report (*Chemistry: Opportunities and Needs*, 1965) of the US National Academy of Sciences provides a comprehensive survey of the state of chemistry in the USA. The report indicates that whereas the use of NMR appeared in less than one per cent of the articles published in the US Chemical Journals in 1958, the figure in 1964 was 18 per cent. The digital computers are now used in about 16 per cent of all articles. So rapid is the rate of development of science and the consequential obsolescence of research equipment and instruments, that no country can really afford to base its research on any large-scale import of foreign equipment and hardware. The level of scientific research in a country is inevitably tied up with the level of its technology and industry.

16.60 A factor of vital importance for an effective science programme at the university level is timely and adequate provision of equipment needed for teaching and research. Every effort should be made to fabricate equipment locally and only such items should be imported as are beyond our resources and ingenuity to produce indigenously.

Active measures will have to be taken to ensure efficient utilization of existing equipment. The UGC should devise some suitable machinery so that research equipment not in use in one university may be transferred to another where it could be put to good use. Also, facilities for fabrication and repair of scientific equipment need to be considerably strengthened. We have already stressed the extreme importance of providing well-equipped workshops in universities and colleges. The UGC and the CSIR should actively encourage and support some of the universities and national laboratories to organize instrument calibration and repair services for general use of the universities. Training of laboratory technicians should receive high priority.

16.61 It is necessary to highlight the importance of study and research in the field of laboratory design. It is not possible for individual institutions to undertake this work on any serious scale, but they all need it and will benefit from it. The problem of laboratory design, and of libraries and educational buildings generally is urgent and important, and it will assume even greater significance in the future in view of large-scale expansion and plans for improvement of educational facilities. We strongly recommend that a special unit for this purpose be set up in the UGC or the Ministry of Education. Its function will be to organize surveys and studies as may be necessary, to render technical advice to the universities and other institutions and to act as a clearing house of information generally.

16.62 *Administration of Science Departments.* Wherever we have visited the science departments of universities we have been seriously concerned about the heavy administrative load carried by the heads of departments. The work of routine administration and procurement of laboratory equipment is often done at too heavy a cost to academic duties; and it is rather distressing to find that a good deal of time of first-rate scientists is wasted on such unproductive work. The administration of science departments needs to be radically reorganized, and without delay. The departments should not be loaded with administrative work except for what is directly related to their functioning and is inescapable. The heads of departments should have full authority with regard to procurement of scientific equipment and apparatus within their annual budget allocations. Adequate assistance for proper maintenance of accounts and general administration should be provided. The system of internal audit which has been introduced in some universities is certainly desirable in dealing with building construction and general stores, but it has hardly any utility in relation to the work of teaching departments. On the other hand it often leads to needless delay and irritation.

16.63 We consider the question of administration of science departments of such importance and urgency that we are inclined to quote at some length from a note given to the Commission by one of our most distinguished scientists:

One of the greatest hurdles in achieving an uninterrupted flow of scientific work is the present procedure of obtaining sanctions through a chain of officials which include the Superintendent of the Accounts Office, the Assistant Registrar, the Finance Officer and still higher authorities. Similarly, a research worker, who requires a plug point to be repaired, often waits for months helplessly chasing papers from one official to another and making telephone calls to various persons from the engineer downward . . . It is a pity that the universities follow a penny-wise and pound-foolish policy in attaching so little value to the time of their top scientists . . . Presently the head of a large science department is largely a glorified clerk, an accountant and a filler of forms. He is appointed to do teaching and research work but the general set-up around him is such as to lay a dead hand on both teaching and research. Those, who still manage to do something, do it at the expense of their personal affairs and neglect of their families.

16.64 If a science department is to make full use of its resources, it is necessary to associate the staff with the administration and decision-making in the department. We have recommended elsewhere the establishment of departmental committees which should function in science departments also. The committee should normally meet at least three or four times a year if not once every month. It should deal with the distribution of available funds between teaching and research, choice of special equipment, admission of students specially at the postgraduate and research levels, and should also be consulted informally regarding selection of academic staff. It would be desirable to establish the committees by university ordinance or regulation. Its proceedings should be submitted to the vice-chancellor for his information and the Executive Council. The university regulations should also provide for the delegation by the head (with the approval of the vice-chancellor) of such of his powers and responsibilities as may be necessary from time to time.

16.65-66 *Pure and Applied Research.* We should now turn to the subject of pure and applied research. It is often stated that universities should perform almost exclusively pure (basic) research, leaving applied research and development in all branches of science to other institutions. This belief is based on an image of university role and of research which prevailed among a minority of university teachers in the scientific

world some decades ago. The universities, in the industrialized countries, as shown by the distribution of the national research potential and programme, make a substantial contribution to applied research, and some of them to a small degree even in development research. Today with the advance of science and technology the distinction between pure and applied research—between a research scientist and a research engineer—has become artificial and in several fields (e.g., electronics) it has almost disappeared. The same individual may be working at one time on pure research and at another time on an applied problem. The difference between pure and applied work is one of motivation and goals, and not of techniques and creativity. In pure research, one is concerned primarily with gaining a new insight or discovery of new knowledge, whereas in applied work the objective is to meet some felt needs in industrial development or production: applied research usually carries a time schedule limit for its completion. We strongly recommend that applied work such as developing important new techniques (new for the country) or designing and fabricating special instruments or apparatus should receive proper recognition, and it should be made possible for such work to earn Ph.D. awards. Also it should be mentioned that whereas in the case of pure science a research contribution must bear international comparison to be of any value, the same is not equally valid in the field of applied science. In the case of pure research, the value of a contribution in a particular field lies in the stimulus it provides to research in that field, but in the case of applied research, the value of a contribution lies in the stimulus it gives to local development of instrumentation, processes and techniques.

16.67 In this context it may be observed that pure science enjoys almost everywhere much greater prestige than applied research; and, if anything, this is more accentuated in countries where science is comparatively a new thing. Unless special care is taken, pure research will tend to dominate, and drive out applied work. It seems that, left to itself, there is nearly always a tendency for research (even in project-oriented laboratories) to become 'purer and purer' unless there are strong counteracting forces. This needs to be kept in view in the organization of research in technological institutions. These should place special emphasis on applied and industrial research.

16.68 In his discussions with us, Professor P. M. S. Blackett particularly stressed the importance of applied research for a developing country like India. This necessarily implies close and intimate co-operation between research in the universities and engineering institutions, usefully employing not only engineers but pure science investigators. The problems of industrial research need to be jointly tackled on a cooperative basis by staff in the universities and engineering

institutions as well as those working in industry. There could and should be a movement of staff from universities to industry and *vice versa*. Consultancy and advisory positions and even directorships in industrial concerns can be offered to academic people. In West Germany industry has put up research institutions in collaboration with some of the university departments, and they work together closely on many projects. This is worth while implementing in India wherever conditions and facilities are favourable.

16.69 In the USSR, educational institutions work in close and active touch with industry. A considerable amount of basic and applied research for industry is carried out in educational institutions (universities and engineering institutes), and is paid for by industry. In certain specialized fields high grade industrial engineers and scientists work on part-time basis as professors in educational institutions. Also, it is quite common for postgraduate students to do a part of their research in industrial establishments using industrial plant and facilities.

16.70 Academician P. Kapitza has in a recent article stressed the following conditions as essential for the application of technical and scientific discoveries to industry:

Favourable moral and material conditions must be provided for industry to learn and adopt new technology. Adopting a new technology means doing something that industry had not done before. The introduction of new technology is, therefore, in the nature of a learning process for the industry.

There must be adequate preliminary training in the industry concerned before attempting to introduce new technology into it. Industry must not be overburdened with too many tasks and assignments.

Effective learning of new technology by industry is possible only in favourable material circumstances.

It is essential to have carefully worked out programmes setting forth the procedures to be followed in carrying out application of new technology to industry.

'Moral conditions' for the cooperation of scientists with industry must be very favourable.²⁰²

A survey has not yet been made showing how in India the university research potential is distributed along basic, mission-oriented basic, applied, and development research. It is essential that this survey be made as soon as possible. One beginning in this direction should be made by analysing the surveys made in various branches of research

²⁰² English translation of Professor P. L. Kapitza's article published in *KOMSOMOLSKAJA PRAVDA* of 20 January 1966.

in Indian universities and by analysing the subject of Ph.D. theses from this point of view.

16.71-72 *Expenditure on University Research.* We shall now turn to expenditure on university research in India. The total expenditure on research and development for the year 1963-64, the latest year for which data is available, may be taken to be about Rs. 600 million, that is, about 0.3 per cent of the GNP. The figure involves a considerable margin of uncertainty, and in part it arises from an element of ambiguity in the definition of research and development. The expenditure incurred by the Central Government is given in Table 16.9; that by the State Governments is shown in Table 16.10.

TABLE 16.9. CENTRAL GOVERNMENT EXPENDITURE ON DIFFERENT SECTORS OF SCIENTIFIC RESEARCH (1963-64)

Sl. No.	Sector	Rs. (in millions)	Percentage
1	2	3	4
1.	Agriculture and Forestry	47.01	9.35
2.	Animal Husbandry, Fisheries and Dairy Research . .	17.95	3.57
3.	Scientific, Industrial and Technological Research . . .	128.21	25.49
4.	Medical, Public Health and Forensic Sciences	26.71	5.31
5.	Irrigation and Power.	18.46	3.67
6.	Geological Survey	37.81	7.52
7.	Atomic Energy	127.54	25.37
8.	Economics and Statistics	21.43	4.26
9.	Archaeological Explorations and Anthropological Survey .	1.96	0.39
10.	Railways	8.13	1.62
11.	Defence	67.60	13.44
	TOTAL	502.81	100.00

Source. *Science in India*, CSIR, New Delhi, 1966.

16.73 The expenditure on university research is obviously hard to estimate, because, apart from other things, there is an inherent difficulty in separating expenditure on research from that on training. As a reasonable estimate, we should take the figure to be Rs. 200 million and it is likely to be less. All the same, the figures demonstrate strikingly the

TABLE 16.10. EXPENDITURE ON RESEARCH AND DEVELOPMENT INCURRED BY THE STATE GOVERNMENTS IN 1963-64

	Rs. (in millions)
1. Agriculture and Forestry	29.87
2. Animal Husbandry, Fisheries and Dairy Research	5.78
3. Scientific, Industrial and Technological Research	1.32
4. Medical and Public Health	12.09
5. Irrigation and Power	2.08
6. Geological Survey	3.20
TOTAL	54.34

Source. Same as for Table 16.9

fundamental weakness of the present structure of research expenditure in the country. *University research receives far too small an allocation and if this is not radically corrected, the future of the entire research effort in the country will be in jeopardy.* A comparison with a country such as the USA or the USSR is perhaps hardly meaningful because the scale of effort is of an altogether different order of magnitude. Still it is interesting to note that industrialized countries spend about 10 per cent of the total research and development effort on university research. If we exclude defence expenditure, the proportion would be about 20 per cent. The Indian figure is very much less, but even this is not the most significant aspect of the situation. *The more important thing is that in all educationally advanced countries the expenditure on university research constitutes about half of the total expenditure on higher education.* Also about one-half of the time, on an average, of university teachers is devoted to research. It is this balance between teaching and research which lends to the universities their peculiar strength and vitality. The percentage of total university expenditure devoted to research in our country is almost negligible. It is this imbalance which we must seek to redress as quickly as possible not only in the interest of university science but also as being crucial to the progress and vitality of science in the country. We are definitely of the view that by the end of the decade, something like a quarter of the total university expenditure should be devoted to research.

16.74 It would be desirable that in the early stages, the UGC makes separate allocations to the universities for support of research. A related matter of great importance is the provision of foreign exchange. The centres of advanced study and major universities described elsewhere

in the Report would need an outlay of at least 50 million dollars in foreign exchange spread over the next 10 years. A similar amount would be required for other institutions of science and engineering in the country. This would give a figure of a 100 million dollars over 10 years, i.e., \$ 10 million per year. In terms of rupees this would amount to Rs. 7.5 crores per year. There is a serious shortage of basic literature in science and technology in our libraries. The supply of journals is inadequate and there is a large demand for back volumes of important periodicals. The expenditure on books and journals alone would account for over a crore of rupees a year.

BASIC RESEARCH OUTSIDE THE UNIVERSITIES

16.75 We would like to draw special attention to one major problem in the field of basic research. At present there are a number of institutions in the country which devote almost their entire effort on university type of research but function outside the university system. These institutions almost invariably (because of personal initiative and other factors) succeed in securing better salaries for their scientists, expensive equipment and generally even more expensive buildings. Be that as it may, at the present level of our resources it will be most unfortunate and short-sighted, almost suicidal, to organize fundamental research divorced from teaching. The real strength of the universities lies in that they combine teaching and research, but this they can do effectively only if adequate facilities for research are made available to them. The time has now come when a serious effort should be made to bring within the universities, or at any rate to link intimately with them, institutions devoted to fundamental research but functioning outside the university system.²⁰³ This is necessary as much in the interest of growth of science in the country as that of the institutions themselves. Institutions engaged in fundamental research and isolated from universities lack the critical and continuing challenge of fresh and youthful minds and cannot last for more than a generation even under favourable conditions. As a matter of national science policy, unless there be very exceptional reasons, the setting up of special facilities and institutions for basic research separate from teaching should be avoided.

16.76 Also, due to the opening of too many research laboratories, the universities have been denuded of their senior teaching and research personnel. As Dr. H. J. Bhabha pointed out in his address to the meeting

²⁰³ Examples of such institutions are: Bose Research Institute (Calcutta); Laboratories of the Indian Association for the Cultivation of Science (Calcutta); Tata Institute of Fundamental Research (Bombay); Physical Research Laboratory (Ahmedabad); Birbal Sahni Institute (Lucknow); Mathematical Research Institute (Madras); Raman Institute (Bangalore).

of the International Council of Scientific Union, a few weeks before his tragic death, '... the attempt to fill senior posts by mature scientists from outside must inevitably lead to their being taken away from the only institutions which have scientists in some measure, however inadequate, in an underdeveloped country, namely, the universities. It cannot be disputed that the cost of building the national laboratories on the lines followed by the Council of Scientific and Industrial Research has been the weakening of the universities by the drawing away of some of their good people, which is their most valuable asset'.

BRAIN DRAIN

16.77 We would like to make a brief reference to the problem of 'brain drain'. It is most desirable for the health and progress of science in our country that a small proportion of *young talent* gets an opportunity for advanced study and research at world-famous centres abroad. The training and research fellowships, including teaching assistantships offered by several countries—by governments, universities, industries, private institutions and foundations—are to be welcomed. A large proportion of research students (some before and others after completing their Ph.D. work) from some of our leading departments of physics and mathematics go abroad every year; and the same applies to post-graduates in engineering and technology from the IITs. Some of our outstanding people are also invited as visiting professors and several are offered appointments for indefinite periods in educational institutions and industry abroad. All this has a side-effect which cannot be ignored. A considerable proportion—we have no precise estimates—of those who go abroad tend to stay indefinitely and a sizable number accept foreign nationality. The migration is largely to the USA. The number of Indian scientists abroad who registered themselves with the CSIR during the last five years was about 6,900 whereas those who returned during the same period was about 2,800.

16.78 Those who go abroad generally obtain far better emoluments than available in the country, and in general also better research facilities. However, not all who go out of India are necessarily first-rate scientists, nor are they of critical importance to the country's requirements. We recognize that the seriousness of the 'brain drain' is often exaggerated, but even so the problem is of sufficient importance to merit a close and systematic study. Talent attracts talent, and even within a country this often leads to dangerous anomalies in the geographical distribution of outstanding scientists and engineers. This is becoming quite a serious problem even in the USA.

16.79 A person with dominating research interests has a dual loyalty, as it were, to his subject and to his community. The first pulls him towards the place where he gets the best 'climate' and opportunities for work, and the second pulls him towards his homeland to share and to improve the lot of those amongst whom he was born and nurtured. The weightage that an individual gives to these at times conflicting forces depends largely on his temperament, his sense of values and social responsibility. Education has an important role to play here. It should promote the sense of commitment to one's people and social responsibility towards them, but in no narrow or chauvinistic sense. It should inculcate a deep sense of duty towards the community in which one had the privilege of being born and brought up. One should regard it as a part of good fortune if through knowledge one could help one's fellow-men in the pursuit of happiness and a worth while life.

16.80 It may be pointed out that in recent years the migration of scientists and engineers between different countries is nearly all one-way—it is a flow into the USA. Between 1952-1963 this influx amounted to more than 4 per cent of the yearly output of US graduates in science and engineering. It reached a peak of 8 per cent in 1957. Table 16.11 gives interesting information about migration of scientists and engineers to the USA.

16.81 The total number of foreign citizens in the US colleges and universities was 91,000 in the academic year 1964-65. Of this 82,000 were students (46% were undergraduates) and 9,000 were teachers or persons holding research appointments. Canada provided the largest number of foreign students (9,253) and India came second with 6,813 students. The UK provided the largest number of faculty members and research appointments (1,166), Japan stood second, and India third (1,002). The distribution of Indian students according to field of major interest was: agriculture 322, business administration 342, education 225, engineering 2,880, humanities 455, medical sciences 285, physical and cultural sciences 1,561, social sciences 690. The number of American citizens abroad in 1964-65 was 22,000. Of this 18,000 were students (about 11,000 to Europe) and 4,000 faculty and administrative staff members.²⁰⁴

16.82 The UK Royal Society Committee which examined this question some time ago reported that 'the emigration of scientists has created some serious gaps in the scientific effort'. Incidentally, we may point out that Japan has hardly any 'brain-drain' problem: the Japanese scientists go abroad in large numbers, but they go on deputation and almost always return to their country.

²⁰⁴Data taken from *Open Doors*, 1965, Institute of International Education, New York.

TABLE 16.11. MIGRATION OF SCIENTISTS AND ENGINEERS TO THE USA

Country of last permanent residence	Immigrants into the USA (Annual average 1956-61)			Immigrants as a percentage of 1959 output of science and engineering graduates		
	Scientists	Engineers	Scientists and Engineers	Scientists	Engineers	Scientists and Engineers
France	26	56	82	0.5	1.2	0.9
FR Germany	124	301	425	6.0	9.8	8.2
Netherlands	34	102	136	7.9	21.8	15.1
United Kingdom . . .	155	507	662	2.6	17.2	7.4
TOTAL WESTERN EUROPE	339	966	1,305	2.5	8.7	5.4
Austria	23	43	66	..	10.9	7.0*
Greece	14	50	64	3.6	20.7	10.2
Ireland	13	32	45	4.7	15.4	9.3
Italy	29	42	71	0.9	1.7	1.3
Norway	6	72	78	3.4	23.8	16.2
Sweden	8	97	105	1.3	16.3	8.8
Switzerland	38	96	134	10.6	22.4	17.0
ALL EUROPE (including others) . .	549	1,684	2,233	..	..	..
Canada	212	1,027	1,239	12.5	48.0	32.3
ALL COUNTRIES . . .	1,114	3,755	4,869	..	..	..

* Estimated.

Source. *Scientific Manpower from Abroad*, NSF 62-24, Washington, and *Resources of Scientific and Technical Personnel in the OECD Area*, OECD 3rd International Survey, Paris, 1963.

FELLOWSHIPS FOR OVERSEAS TRAINING

16.83 Apart from fellowships awarded by foreign agencies, there is a real need for institution by the government of a limited number of research fellowships, say about 100, to be awarded every year for study and research abroad. These fellowships should be awarded to persons of outstanding ability, selected on an all-India basis and in subjects related

to our teaching and research needs. The awardees should hold teaching or research appointments (or be pre-selected for such appointments) and there should be some form of 'bonding' for them to return to their institutions. Also no less important is the training of technicians for specialized work. We should avail of the research and training facilities in countries like Japan, Sweden, France, Germany, besides the USA, the UK, and the USSR for the purpose.

NATIONAL SCIENCE POLICY

16.84 Science policy and decisions concerning science now play such a vital role in the national economy and defence that it is most important for the governmental authorities at the highest level to ensure that on major scientific issues they can get advice which is as impartial and objective as it possibly can be. It is important to have an advisory body which is appropriate for this purpose. Such a body should have on it, besides heads of major agencies concerned with scientific research, persons who have a high standing and regard in their professions and who inspire general confidence—a proportion of these members should be distinguished young scientists in their thirties. The number of such persons should not be less than the agency heads. They could be from the universities, research institutions (government or non-government), industry and public life. The advisory body should also have on it not only scientists and technologists but also economists and social scientists and persons with experience of industry and management.

16.85 A fundamental concern of science research policy is the relative allocation of priorities with reference to different sectors of scientific effort, both in terms of subjects and in terms of operating agencies. This is a problem which involves vital scientific issues, but it goes beyond science. It involves important economic and political considerations. The resources in men and material available at any time for R and D are severely limited. This is so even for affluent countries. The number of able scientists and engineers is often the critical factor in determining the total volume of the R and D effort. Difficult and sometimes unpleasant choices have to be made among the many competing claims on the use of the available talent and professional manpower. This is inevitable, and a responsibility which cannot be shirked. To lay down effective and operational priorities is not at all an easy thing. It needs a relatively well-defined formation of the national goals and objectives, and it needs hard, courageous and imaginative thinking.

16.86 The present Scientific Advisory Committee to the Cabinet cannot perhaps be considered to have effectively performed the functions envisaged above, no matter what its terms of reference are. The

Committee is mainly constituted of representatives of the important research organizations in the country. This makes, to say the least, an objective and critical examination of issues of national research policy difficult. The members are often too directly involved to be able to take an objective and detached view. In most of the advanced countries the top Advisory Committee is composed of people who have no 'vested interests' in an institution to defend or to fight for.

16.87 We recommend that the Scientific Advisory Committee be reorganized and provided with an effective secretariat with a professional component adequate to its tasks. The Committee should be in a position to assess the broad scientific needs of the country including the universities and advise government on science policy and allocation of total resources between different sectors of scientific activities. The task of this body should be to review continuously the national research policy situation.

16.88 Recently the Atomic Energy Department has undertaken a programme for research in radio astronomy and also in the field of molecular biology. The interest of the AEC in these fields is to be welcomed. But it needs to be stressed that these fields of research should primarily be developed and supported in the universities unless there be compelling reasons to the contrary (we are not aware of such reasons).

16.89 We should like at this stage to say a word about the Research Councils. We have the Council of Scientific and Industrial Research, the Indian Council of Agricultural Research, the Medical Research Council and the Defence Research Council. It is our view that bodies concerned with science policy and implementation and which have executive and managerial functions requiring detailed and expert examination of diverse issues should ordinarily have professional scientists, engineers or science administrators of high standing as their chairmen.

16.90 We may mention that in most of the scientifically advanced countries the organization at the national and governmental levels of research has undergone drastic changes during the last five years or so. In the UK, following the Trend Committee Report, the Department of Scientific and Industrial Research (which corresponds to the CSIR) has been completely overhauled. In its place there has been constituted the Science Research Council which deals with those functions of the DSIR which were concerned with basic research, fellowship awards and research grants to universities. Several of the DSIR laboratories, including the National Physical Laboratory have been transferred to the new Ministry of Technology with a view to bringing the laboratories into closer relationship with industry. The AEC is with the Ministry of Technology. There is also an Advisory Council on Science Policy.

16.91 It should be a major task of the national research policy, and

policies of the universities to provide a 'climate' conducive to research, and to prevent and eliminate, through energetic and public measures, all dangers and infringements of autonomy and freedom of action in research. It should be recognized that all this needs deliberate effort, and it also takes time. To quote Michael Polyani: 'Those who have visited the parts of the world where scientific life is just beginning, know the back-breaking struggle that the lack of scientific tradition imposes on the pioneers. Here research work stagnates for lack of stimulus, there it runs wild in the absence of any proper directive influence. Unsound reputation grows like mushrooms, based on nothing but commonplace achievements, or even more on empty boasts... However rich the fund of local genius may be, such environments will fail to bring it to fruition.'

16.92 In the case of scientific work, zest and enthusiasm of high quality are extremely important. This needs freedom from petty worries and distractions, a proper research climate and a good morale among scientists. It is no easy thing to build scientific institutions with international reputation. These demand single-minded effort, devotion and dedication.

16.93 In determining our priorities for research we should be guided by our own national needs and not be unduly influenced by what may happen to be the current fashion in science. If space research and nuclear physics are given a high place in a nation's programme of research, it will be futile to expect that the young talent will elect agriculture or industrial research. If marble floors and possession of expensive equipment become the outer symbols of scientific status, a waste of national resources in the name of science and research becomes almost inevitable. Fred Hoyle has observed: 'People who work in marvellous buildings are dominated by those buildings, whereas it is the other way round for people who work in rabbit warrens. The builders of the great European cathedrals knew this perfectly well. Walk into a big cathedral and it wipes your brain clean of all thoughts. The same thing happens when you walk into these wonderful modern office blocks. The same thing happens all too easily in big science.'²⁰⁵

SCIENCE ACADEMY

16.94 In the scientific life of a country a national organization or academy of sciences occupies an exceedingly important place. In some ways its role is crucial for the growth of science education and research. While this is not the place to go into the subject at any length, we feel that a brief reference is necessary.

²⁰⁵Fred Hoyle, *Of Men and Galaxies*, University of Washington.

16.95 In India the role of a National Academy is performed partly by the National Institute of Sciences. However, it may need some drastic reorganization, if the Institute is to exercise a vigorous leadership in science and play a more significant role in the scientific activities of the nation. In recent decades the demarcation between science and technology has become increasingly thin and artificial, and for this and other reasons, it may be desirable to widen the scope of the fellowship and bring into the Institute more engineers and technologists. Further, if the Institute is to be seriously concerned with the interaction between science, economic growth and national development, it would be useful to extend the fellowship to economists and social scientists. This is the practice in several academies, the most important being the Soviet Academy of Science.

16.96 In the above context, we may refer also to the Science Council of Japan established after World War II, as it has some features which could perhaps be usefully incorporated in our own organizations. The Council is the legal and official representative body of the scientists of Japan: The JSC has no direct control over research. Its function is to determine what is best for science in Japan and to advise government accordingly. It is under the jurisdiction of the Prime Minister. It has seven divisions: (1) literature, philosophy, pedagogy, psychology and sociology, history; (2) law, political science; (3) economics, commerce and business administration; (4) pure science; (5) engineering; (6) agriculture; (7) medicine, dentistry, pharmacology. The 210 members of the Council, 30 from each of the seven divisions, hold office for three years. They are elected by a nationwide constituency of electors who are either graduates of at least two years' standing or possess five or more years of actual research experience. The Council has a Management Committee of 31 members. The constitution of the Japanese Council is highly democratic. In these days when science impinges on broad issues of economic and national policies, it is desirable that a national organization of scientists is not controlled entirely by the scientific aristocracy, as it were, but the entire scientific community gets a chance to participate in the life and work of the organization.

16.97 Many of the major issues of science policy involve considerations which go outside the strict domain of science. In view of this, and other reasons, it is an advantage for a national organization which claims to speak on behalf of the scientific community to involve in its deliberations some elected representatives of the entire fraternity of science. For a country of the size of India it may not be possible to adopt the pattern of the Science Council of Japan, but the possibility could be explored of associating with the National Institute of Sciences a small number of

scientists (not fellows of the Institute) elected by the scientific community. The number of such members could be limited to about a third of the total strength of the Council. Such an arrangement would help the process of activation of science by bringing closer contact and participation between its different components.

16.98 A national academy has also a major function in promoting international relations in science. Such a body represents the country on international scientific organizations such as the International Council of Scientific Unions and its various committees. India is almost the solitary case of a country which is not represented on the ICSU by a professional academy but by the Government. It is worth mentioning that science academies often help in furthering cooperation between countries amongst which political relations may not be normal.²⁰⁶

CONCLUSION

16.99 The broad conclusions are simple and apparent. But often it is the obvious things which are the hardest to implement:

- Strengthening of university science and research should be conceived as a fundamental goal of national science policy.
- In the universities, good work, good teaching and good research should be energetically and generously supported at all levels. In science the output in terms of achievement is directly proportional to the input in terms of hard and honest work. Work of poor quality and pseudo-research should be ruthlessly discouraged.
- Contacts between the universities and national laboratories, scientific government departments, and industry should be vigorously promoted and strengthened. Any one who has a real competency and willingness to participate in university work should be encouraged to do so. So great and urgent is our need that all resources need to be fully exploited.
- 'Right climate', leadership and dedication are important factors in promoting team-work and in generating scientific work of high quality. Able and gifted men should be given every opportunity for concentrated and sustained work free from petty worries and distractions. Informal and enlightened public support of science (but not lip service or uncritical adoration) is an essential factor in creating a proper climate for scientific work. Science should not only be held in high regard but it should also enjoy the confidence

²⁰⁶For instance, the Academy of Sciences, USA, has shown much initiative in exploring the possibilities of scientific cooperation with the Peoples' Republic of China (*Science*, June 17, 1966).

of the public. The universities have an obligation and a role in promoting public awareness and understanding of the organization and achievement of science in the country, its strength and weaknesses.

- In science departments, the administrative load and 'routine' should be cut down to a minimum.
- Teaching and research are mutually supporting activities. There is no real border line between them—they merge into each other. In their symbiotic combination lies the unique and peculiar strength of the universities.
- Our resources are limited, so one has to spend more thought to get more out of our resources—spending thought is more difficult than spending money.

16.100 Science education and research are crucial to the entire developmental process of the country. The experience of several countries, notably the USSR and Japan has shown that it is only on the basis of purposeful science education and research that a stagnant economy can be radically transformed into an industrial economy in a comparatively short time. The highest priority therefore has to be given to the improvement in the quality, as also a balanced expansion, of science education and research. The responsibility for this rests primarily with the Central Government and the scientific agencies closely associated with it. They alone can provide the necessary leadership and resources.

16.101 We cannot conclude this chapter better than by recalling the memorable words of Jawaharlal Nehru:

Science has developed at an ever-increasing pace since the beginning of the century, so that the gap between the advanced and backward countries has widened more and more. It is only by adopting the most vigorous measures and by putting forward our utmost effort into the development of science that we can bridge the gap. It is an inherent obligation of a great country like India, with its traditions of scholarship and original thinking and its great cultural heritage, to participate fully in the march of science, which is probably mankind's greatest enterprise today.²⁰⁷

²⁰⁷Statement in Parliament on the Science Policy Resolution.

SUMMARY

1 *General Principles.* The progress, welfare and security of the nation depend critically on a rapid, planned and sustained growth in the quality and extent of education and research in science and technology. It is unfortunate that India today is almost at the bottom end of the ladder of GNP *per capita*, as also of the ladder of *per capita* expenditure on education and research. In view of the limited resources available, the following measures are needed to make rapid progress:

- (1) A rigorously selective approach has to be adopted.
- (2) In postgraduate studies and research, the standards of attainment must bear international comparison. The only way this can be done is through a most careful selection of subjects for advanced study and research, selection of the most able students for such courses, and by building a small number of centres of excellence and assigning to each of these, resources exceeding a certain critical size.
- (3) In the utilization of our scientific manpower we must strive our utmost to achieve high efficiency—higher even than in the industrially developed countries. We should determine our priorities and programmes in education and research on the basis of hard 'indigenous' thinking and needs, and not follow the fashion set by other countries whether highly 'advanced' or not so advanced.
- (4) The development of science must derive its 'nourishment' from our cultural and spiritual heritage and not bypass it.
- (5) The need from the earliest stage of science education for a proper understanding of the basic principles and the process of scientific abstraction and creative thinking must be emphasized.

16.01-14

2 *Science Education.* (1) Apart from improving the standard of the postgraduate courses, the postgraduate enrolments in science and mathematics need to be expanded several-fold in the coming decades to meet the demands of rapidly expanding secondary and higher education and of research and industry. 16.22

(2) It is necessary to develop a number of Centres of Advanced Study in science and mathematics. Their academic staff should be of the highest quality and should include, wherever possible, some persons of international standing. There should also be a number of visiting professorships on contract appointments for a period of two to three

years. The UGC should constitute an all India committee to make offers of such visiting professorships. Some of the internationally famous Indian scientists at present working abroad as well as distinguished foreign scientists could be invited under this scheme.

16.23

(3) The regional imbalances in the development of science education should be reduced to the minimum. The development of science and technology in a State should be related closely to its potential for economic growth.

16.24

(4) There is an urgent need to revise drastically the undergraduate and postgraduate curriculum in science.

16.25

(5) In our science departments a proper balance between experimental and theoretical aspects should be maintained. Special and urgent attention should be paid to the development of experimental physics and chemistry. In the field of biology, the study of micro-organisms and their role in medicine and agriculture deserves much more attention than is generally the case. Astronomy and astro-physics also need emphasis.

16.26-27

(6) There should be well-equipped workshops in every college and university department of science. Students should be encouraged to learn the use of workshop tools and get acquainted with some of the essential laboratory techniques and practices. The workshops should work far more intensively than is usually the case. It would be desirable to permit their use by industrial workers enrolled for evening and correspondence courses.

16.28

(7) Students in science subjects should have some knowledge of the theory of errors, basic statistical concepts, and statistical design of experiments.

16.29

(8) Apart from the evaluation of class records and the experiments performed by students, there need be no practical examinations as part of the final examination.

16.29

(9) There is urgent need to introduce an element of flexibility and innovation in the organization of courses for the Master's degree. Combination courses consisting of, say, one major subject and one subsidiary subject should be provided.

16.30

(10) It will be a great advantage if major departments in life sciences have on their academic staff a small number of physical scientists (including mathematicians) specially selected for their interest in the study of biological phenomena.

16.31

(11) The need of the day is to bring science and technology closer together in our educational system.

16.31

(12) Apart from the regular two-year M.Sc. courses there is need to provide one-year courses, or of even shorter period, for specialized

training in subjects relevant to present scientific, industrial and other needs. These courses could be provided by selected science and technology departments in universities, engineering and agricultural institutions or the National Laboratories. 16.32

(13) It would be desirable for universities and engineering institutions to enrol qualified industrial workers for evening and correspondence courses. Apart from the usual diploma and pass degree courses, special courses to train precision mechanics, laboratory technicians and other skilled operators should be organized. 16.34

(14) There is need for the introduction of a new degree beyond the M.Sc. stage. The course should include with advantage, on an optional basis, elements of pedagogy. 16.35

(15) The programme of the summer science institutes brings together, in active participation, school and college teachers and leading university professors. It is a major instrument in the country's effort towards the improvement of science education. It should be expanded and followed up. 16.37

(16) The IUB and the UGC should take a lead to ensure that, by the end of the Fourth Plan, most of the books required at the undergraduate level and a considerable number at the postgraduate level are produced in the country. 16.38

(17) We welcome the steps taken for the evolution of a scientific terminology in the Indian languages. It has to be pursued further. It would be an advantage if science students are taught the few Latin roots from which a large number of international terms are derived. 16.39

3 *Investment in Research.* In an age characterized by science and technology, research is almost a necessary precondition for all kinds of human endeavour. In the industrially advanced countries the growth of investment in research and development and of manpower engaged in these activities, has surpassed all expectations. The Indian expenditure on R and D is 0.3 per cent of the GNP; and the total strength of scientists and engineers is only a few hundredths of one per cent of the labour force. The number of qualified scientists and engineers is of the order of a hundred thousand. Our effort in R and D will have to be stepped up. 16.40-44

4 *University Research in Science.* A major weakness of Indian education and research is the relatively very small part played by the universities in the sum total of Indian research which itself is far smaller than what it should be in relation to our capabilities and needs. A stage has now been reached when deliberate support and encouragement of

advanced study and research in the universities should become a fundamental goal of our national policy. 16.46

(1) The creative scientists and engineers of a country are one of its most precious and scarce assets and should find place in the universities where their 'multiplier effect' is generally maximum: they contribute not only to scientific research but also to the building up of new talent. 16.48

(2) It is important that more and more university people—that is teachers and students—should perform more and more research work and of a better and still better quality. As an ultimate goal, every university researcher should become a teacher and every teacher a researcher. 16.48

(3) Publication of qualitative research, apart from good teaching ability, should become one of the basic criteria for advancement of teachers in their university career. Gifted students even at the undergraduate stage should be encouraged to participate in some form of research activity. 16.48

(4) Wherever practicable, active scientists in the CSIR, AEC and other research institutions outside the university system should be invited and inducted to participate in teaching and research work, full-time or part-time, for short or long periods. 16.48

(5) It should be made possible for selected postgraduate students to spend, during their course work, a term or two in another university or institution specializing in the subject of their interest. 16.48

(6) The UGC scheme of assisting teachers, research workers, and laboratory technicians to visit universities and research institutions for short periods (a few weeks to a few months) should be considerably expanded. 16.49

(7) The development of team-work is an essential condition for the improvement of the quality of university. But it should be real. It should be a part of university research policy to eliminate ruthlessly spurious and parasitic 'team-work'. 16.50

(8) The number of research studies under the supervision of the head of the department or any other teacher should be limited. Research students should also be assigned to younger members of the staff. 16.51

(9) The qualifications for Ph.D. enrolment need to be upgraded. We should encourage research-minded engineering graduates to go in directly for Ph.D. in mathematics, physics and other science subjects. 16.51

5 *Mathematics.* It is important that a deliberate effort is made to place India on the 'world map of mathematics' within the next two decades or so. Advanced centres of study in mathematics should be

established at three or four universities in the next five to ten years.

16.53

(1) At least one of the major departments of mathematics in the universities should be encouraged to take an active interest in exploring the possibilities of *programmed learning* in mathematics for upgrading the knowledge and understanding of school and college teachers.

16.54

(2) One or two special secondary schools for pupils with unusual mathematical ability should be set up in the near future.

16.55

(3) A special effort should be made by the UGC to provide computation installations and training in programming on a selective basis in the universities. By the end of the Fourth Plan a good proportion of the universities should have basic computer facilities to serve the requirements of study and research in science, mathematics and social sciences.

16.57

(4) It would be desirable to support energetically and develop one or two active centres for the study of brain and psychosomatic phenomena, using modern techniques and also drawing upon past Indian experience in this field which even today in some ways is of great significance.

16.58

6 *Equipment.* (1) Measures will have to be found for efficient use of existing equipment and only such equipment as cannot be produced within the country and whose import is inescapable should be imported.

(2) The UGC and the CSIR should actively encourage and support some of the universities and national laboratories to organize instrument calibration and repair service for the general use of the universities. Training of laboratory technicians should receive high priority.

(3) A special unit should be set up to study and do research in laboratory design.

16.59-61

7 *Administration of Science Departments.* The administration of science departments needs to be radically reorganized, and without delay. If it is to make the fullest use of its resources, it is necessary to associate its staff with administration and decision-making in the department.

16.62-64

8 *Pure and Applied Research.* (1) It is wrong to assume that universities should perform almost exclusively pure (basic) research, leaving applied research and development in all branches of science to other institutions. The universities, in the industrialized countries, as shown by the distribution of the national research potential and programme, make a substantial contribution to applied research, and some of them to a small degree even in development research.

(2) Today, with the advance of science and technology, the distinction between pure and applied research—between a research scientist and a research engineer—has become artificial, and in service fields (e.g., electronics) it has almost disappeared. Applied work such as developing important new techniques (new for the country) or designing and fabricating special instruments or apparatus should receive proper recognition, and it should be made possible for such work to earn Ph.D. awards.

(3) Left to itself, there is nearly always a tendency for research (even in project-oriented laboratories) to become 'purer and purer'. This needs to be kept in view in the organization of research in technological institutions. These should place special emphasis on applied and industrial research.

(4) A survey has not yet been made showing how in India the university research potential is distributed along basic, mission-oriented basic, applied and development research. It is essential that this survey be made as soon as possible. 16.65-70

9 *Expenditure on University Research.* (1) University research receives far too small an allocation and if this is not radically corrected, the future of the entire research effort in the country will be in jeopardy. By the end of the decade, something like a quarter of the total university expenditure should be devoted to research.

(2) It would be desirable that in the early stages the UGC makes separate allocations to the universities for support of research.

(3) A related matter of great importance is the provision of adequate foreign exchange. 16.71-74

10 *Basic Research Outside the Universities.* At present there are a number of institutions in the country which devote almost their entire effort on university type of research but function outside the university system. A serious effort should be made to bring them within the universities, or, at any rate, to link them intimately with universities. 16.75-76

11 *Brain Drain.* A considerable proportion—we have no precise estimates—of those who go abroad tend to stay indefinitely and a sizable number accept foreign nationality. The migration is largely to the USA. Not all who go out of India are necessarily first-rate scientists, nor are they of critical importance to the country's requirements. But the problem is of sufficient importance to merit a close and systematic study. 16.77-82

12 *Fellowships for Overseas Training.* Apart from fellowships awarded by foreign agencies, there is a real need for institution by the government of a limited number of research fellowships, say about 100, to be awarded every year for study and research abroad. These fellowships should be awarded to persons of outstanding ability and there should be some form of 'bonding' for them to return to their country.

16.83

13 *National Science Policy.* (1) It is most important for the governmental authorities at the highest level to ensure that on major scientific issues they can get advice which is as impartial and objective as it possibly can be. For this, it is essential to have an advisory body which should have on it, besides heads of major agencies concerned with scientific research, persons who have a high standing and regard to their professions and who inspire general confidence—a proportion of these members should be distinguished young scientists in their thirties. The number of such persons should not be less than the agency heads. They could be from the universities, research institutions (government or non-government), industry and public life. The advisory body should also have on it not only scientists and technologists but also economists and social scientists and persons with experience of industry and management. The Scientific Advisory Committee to the Cabinet should be reorganized on the above lines and provided with an effective secretariat and with a professional component adequate to its tasks. The Committee should be in a position to assess the broad scientific needs of the country including the universities and advise government on scientific policy and allocation of total resources between different sectors of scientific activities. It should also review continuously the national research policy situation.

(2) Bodies concerned with science policy and implementation and which have executive and managerial functions requiring detailed and expert examination of diverse issues should ordinarily have professional scientists, engineers or science administrators of high standing as their chairmen.

(3) It should be a major task of the national research policy, and policies of the universities to provide a 'climate' conducive to research, and to prevent and eliminate, through energetic and public measures, all dangers and infringements of autonomy and freedom of action in research.

(4) In determining our priorities for research, we should be guided by our own national needs and not be unduly influenced by what may happen to be the current fashion in science.

16.84-93

14 *Science Academy.* (1) In India the role of a National Academy is performed partly by the National Institute of Sciences. However, it may need some drastic reorganization, if the Institute is to exercise a vigorous leadership in science and play a more significant role in the scientific activities of the nation.

(2) India is almost the solitary case of a country which is not represented on the ICSU by a professional Academy but by the Government. This function should be a responsibility of the Academy.

16.94-98

CHAPTER XVII

ADULT EDUCATION

17.01 Education does not end with schooling but it is a life-long process. The adult today has need of an understanding of the rapidly changing world and the growing complexities of society. Even those who have had the most sophisticated education must continue to learn; the alternative is obsolescence.

17.02 One of the major planks in the strategy of a society which is determined to achieve economic development, social transformation and effective social security should be to educate its citizens to participate in its developmental programmes willingly, intelligently and efficiently. This is particularly urgent in a society in which masses of people have missed schooling and in which the education given has been irrelevant to the developmental needs. The farmer who tills the soil or the worker who turns the machine must understand the nature of the soil and the machine and acquire some acquaintance with the scientific processes involved in production in order to be able to adopt new practices and improve upon them. Mere persuasion or coercion cannot arrest population growth; people must understand the implications of unchecked increase in population, acquire some knowledge of the laws of life and appreciate individual responsibility in programmes of family planning. No nation can leave its security only to the police and the army; to a large extent national security depends upon the education of citizens, their knowledge of affairs, their character and sense of discipline and their ability to participate effectively in security measures.

17.03 Thus viewed, the function of adult education in a democracy is to provide every adult citizen with an opportunity for education of the type which he wishes and which he should have for his personal enrichment, professional advancement and effective participation in social and political life.

17.04 In normal conditions, programmes of adult education presume universal literacy. In the Indian context 70 per cent of the people are unable to read and write and, naturally, liquidation of illiteracy becomes a matter of immediate national concern.

17.05 The scope of adult education is wide: as wide as life itself. Its requirements are somewhat different from those of the normal school system. It depends upon the support it receives from several agencies, particularly the universities and public institutions and libraries. The

effectiveness of the programmes of adult education depends upon a competent administrative machinery.

17.06 An effective programme of adult education in the Indian context should envisage the following:

- liquidation of illiteracy;
- continuing education;
- correspondence courses;
- libraries;
- role of universities in adult education; and
- organization and administration of adult education.

We shall discuss these in the present chapter.

LIQUIDATION OF ILLITERACY

17.07 *The Need for Action.* India was more non-literate in 1961 than in 1951, with an addition of about 36 million non-literates. In 1966, it has 20 million more non-literates than in 1961. This has happened despite unprecedented expansion of primary education and despite many literacy drives and programmes. Though the percentage of literacy has risen from 16.6 per cent in 1951 to 24 per cent in 1961 and 28.6 per cent in 1966, a faster growth of population has pushed the country further behind in its attempts to reach universal literacy. The moral is obvious: conventional methods of hastening literacy are of poor avail. If the trend is to be reversed, a massive unorthodox national effort is necessary.

17.08 The price which the individual as well as the nation pays for illiteracy is high, although one grows accustomed to the persisting malady and becomes insensitive to the harm it does. The circumstances of modern life condemn the non-literate to live an inferior existence. He has little prospect of a reasonable income. He remains isolated from sophisticated social processes, such as democratic government and commercial marketing. The uneducated is not in reality a free citizen. Illiteracy as a mass phenomenon blocks economic and social progress, affects economic productivity, population control, national integration and security and improvement in health and sanitation. In the words of Prof. V. K. R. V. Rao, Member, Planning Commission, 'Without adult education and adult literacy, it is not possible to have that range and speed of economic and social development which we require, nor is it possible to have that content, or quality or tone to our economic and social development that makes it worth while in terms of values and welfare. A programme of adult education and adult literacy should

therefore take a front place in any programme for economic and social development.²⁰⁸

17.09 There can be little disagreement with the above general statements which, in one way or another, were recognized even before Independence. But the principal strategy adopted so far to make the people literate has been to place an exclusive emphasis on the development of a programme of free and compulsory education for all children till they reach the age of 14 years. If this could have been effectively implemented by 1960, as once visualized, the problem would have been considerably simplified. However, for reasons which have been examined elsewhere, it has not yet been possible to implement the programme and we can at best hope to provide five years of effective education to every child by 1976 and of seven years by 1986. Moreover, the system of primary education continues to be largely ineffective and wasteful and many children who pass through it either do not attain functional literacy or lapse into illiteracy soon afterwards. If we are to continue our dependence on this programme alone for the liquidation of illiteracy, we may not reach our goal even by 2000 A.D.! It is, therefore, evident that, while our efforts to develop a programme of free and compulsory education should continue with redoubled vigour, a time has come when a massive and direct attack on mass illiteracy is necessary.

17.10 This is not to say that no direct attack on mass illiteracy has been launched so far. In fact, the history of adult education during the last thirty years shows that many literacy drives have been organized on a State or a local basis, which were launched with considerable drive and enthusiasm but which petered out in apathy and dissipated efforts a few years later. There are several reasons for this. The campaigns were too limited in scale to achieve a significant advance and generate enthusiasm for further effort. They also tended to be sporadic and uncoordinated—government departments, voluntary agencies, educational institutions and individuals working more in isolation than in active collaboration with other agencies. They were often launched hastily, without the careful assessment of the needs and interests of adults, without awakening public interest or stimulating the desire to learn and without adequate provision for the follow-up work in the absence of which no lasting results could be obtained. It is, therefore, not surprising that they failed.

17.11 Sustained support and purposeful orientation of literacy programmes depend upon conscious acceptance of certain basic facts. For instance, it should be accepted that the pace of industrialization and modernization of agriculture and in general of the economic progress of

²⁰⁸Dr. V. K. R. V. Rao, *Education and Human Resource Development*, Allied Publishers, New Delhi, 1966.

the country is inhibited by the large number of non-literates who constitute the 'work-force'. Assuming that the age-group 15-44 constitutes the work force, it includes 144 millions of persons or 67.4 per cent of the age-group who are non-literate. Further, non-literate people tend to resist change and cling to traditional forms of life, while modernization of social life demands revolutionary changes in the accepted pattern. Illiteracy among the masses is inconsistent with the spirit of the age in which scientific and technical progress determines the way of life and standards of living. New ideas and new practices cannot be effectively communicated to minds which are untrained to receive them and to make use of them. Whether it is family planning or improvement of sanitary standards or any programme of social security or any move which requires change of attitude and habits of life, it must make sense to the people. Similarly, it should be realized that uneducated people cannot make a real democracy, the essence of which lies in participation by the people in organized civic life and in important decision-making. The Universal Declaration of Human Rights, Article 26 of which states that every one has a right to education, applies equally to the adults of the future as to those of the present. The existence of the vast masses of non-literate people in our country which prides itself on its noble traditions of learning, is humiliating. These are simple and self-evident facts which are seldom disputed. It is, however, necessary to realize that an effort commensurate with the magnitude of the task of eradication of illiteracy is inconceivable unless there is a clear conviction on the part of the national leadership that the education of the masses of non-literates has a direct bearing on economic and social progress and on the quality of national life. Lack of conviction is evident from the fact that so far there has been no political commitment to any programme of adult education. This may be due to some extent to the magnitude of the problem. The numbers involved are so great, resources demanded in terms of finance and trained personnel so apparently enormous, that there is a natural tendency, particularly in the face of the competing priorities, to give up the goal as unattainable and to leave the solution to time and to the development of universal primary education. This attitude is unhelpful. We think that the problem must be faced resolutely and realistically and we are convinced that indifference to it will not remain unpunished.

17.12 To put an end to this intolerable situation, we recommend a nationwide, coherent and sustained campaign despite lack of resources in view of the urgency of the problem. The campaign should be inspired by a faith in its vital significance to national life and should be organized and supported vigorously by the social and political leadership in the country. It should involve the

Central, State and Local governments, all governmental agencies, all voluntary agencies and private organizations and industries, all educational institutions ranging from the universities to primary schools and, above all, all educated men and women in the country. A lesser effort will fail to generate the necessary motivation and build up effective momentum. The task is enormously difficult. It requires a spirit of dedication, imaginative organization, intelligent cooperation of all agencies involved and ungrudging effort and sacrifice on the part of the workers. However, the task can be achieved; it was achieved in the USSR immediately after the Revolution. The determined Russian effort gained for the country much more than mere universal literacy. It gave the people a sense of achievement and national pride and prepared it for participation in social transformation. The situation in India is somewhat different, but a mighty effort similar to the Russian will be an educational experience of great national significance.

17.13 *The Targets.* The essential condition for success in a literacy programme is that it should be very carefully planned and that all necessary preparations should be made well ahead in time. Organization of massive programmes, preparation of material, training of personnel and a number of other requisites require time. We do not visualize launching a nationwide programme in all parts of the country at the same time. It is, however, possible to proceed systematically from area to area in each State according to the opportunities available and gradually to cover the entire State and the country. It will be possible to achieve full literacy in different areas at different times depending upon the stage of educational development in the area, public cooperation and efficiency of organization. Time is an essential factor in combating illiteracy and a delay of more than 10 or 15 years in liquidating the problem on a massive scale will defeat its very purpose. We think that with well-planned efforts it should be possible to raise the national percentage of literacy to 60 per cent by 1971 and to 80 per cent in 1976. These targets will no doubt require tremendous effort and organization; but they are not impracticable. We recommend that every possible effort should be made to eradicate illiteracy from the country as early as possible and that in no part of the country, however backward, should it take more than 20 years to do so.

17.14 *The Concept of Literacy.* We do not equate literacy with the mere ability to read and write. Literacy, if it is to be worth while, must be functional. It should enable the literate not only to acquire sufficient mastery over the tools of literacy but also to acquire relevant knowledge which will enable him to pursue his own interests

and ends. The World Conference of Education Ministers on the Eradication of Illiteracy organized by UNESCO at Teheran (1965) concluded 'that rather than an end in itself, literacy should be regarded as a way of preparing man for a social, civic and economic role that goes far beyond the limits of rudimentary literacy training, consisting merely in the teaching of reading and writing. The process of learning to read and write should be made an opportunity for acquiring information that can immediately be used to improve living standards; reading and writing should lead not only to elementary general knowledge but to training for work, increased productivity, a greater participation in civil life, a better understanding of the surrounding world and should, ultimately, open the way to basic human culture'. We agree with the view taken by the Conference. Literacy programmes should inspire and enable the adult to use his knowledge of literacy for his own further education and encourage him to profit by the scheme of continuing education which we propose to discuss subsequently. Thus viewed, literacy programmes should have three essential ingredients.

- (1) It must be, as far as possible, 'work-based' and aimed at creating attitudes and interests and imparting skills and information which will help a person to do efficiently whatever work he is engaged in.
- (2) It must help the non-literate to interest himself in vital national problems and to participate effectively in the social and political life of the country.
- (3) It must impart such skills in reading, writing and arithmetic as would enable him, if he so wishes, to continue his education either on his own or through other available avenues of informal education.

It follows that literacy programmes will have three stages. The initial stage will consist of acquaintance with reading, writing and arithmetic and some general knowledge relating to civic and national problems in which the entire society is involved and to the profession in which the learner is engaged. The second stage should deepen the knowledge and skills gained in the initial stage and train the adult in using literacy gained for solving personal problems and enriching personal life. The third stage should lead the adult to one of the programmes of continuing education.

17.15 Programmes for Arresting the Growth of Illiteracy. The first step to liquidate illiteracy should be to arrest the swelling of the numbers of non-literates by

- expansion of universal schooling of at least five years' duration as rapidly as possible to the age-group 6—11;

- providing part-time education to those children of the age-group 11—14 who either missed schooling or dropped prematurely out of the school; and
- providing part-time general and vocational education to young adults of the age-group 15—30 who have received some years of schooling but insufficient to carry them to a stage of permanent literacy or to prepare them adequately for the demands made on them by their environment.

17.16 In Chapter VII (Vol. II) we considered programmes for the realization of universal primary education for the age-group 6—11. We have also recommended provision of part-time education of one year's duration for the age-group 11—14 on a voluntary basis to start with but with the hope of making it compulsory later when suitable conditions are created. We also consider it necessary that these facilities should be extended to those in the age-group 15+ whose schooling has been inadequate. These steps, combined with the extension of school facilities and improvement in the holding power of the schools, as proposed elsewhere, must form the base of a fight against illiteracy.

17.17 *The Strategy.* Planning for literacy must reckon with the magnitude and complexity of the situation obtaining in the country. It is not proposed to analyse the position in this chapter; but a picture of the size of the undertaking can be formed by the fact that there are, according to the 1961 Census, 189 million non-literate adults (age-group 15+) in the country. Urban areas have a much higher literacy (47 per cent) than the rural areas (19 per cent). The map of literacy shows very wide variation from area to area in the country and ranges from 52.7 per cent in Delhi to 1.8 per cent in NEFA.²⁰⁹ There is also a wide variance in literacy among men and women in different parts of the country, and among different social groups. Motivation for education varies from area to area depending upon several factors such as development of education and industrialization. Obviously there can be no single or simple approach to tackle the problem; each situation will need very special investigation and remedial measures will depend upon such opportunities as are locally at hand or can be made available. We feel that we can only indicate certain general principles.

17.18 We recommend a two-fold strategy for combating illiteracy in the country which, for the sake of convenience, we may call:

- (a) the selective approach; and
- (b) the mass approach.

Programmes planned on the basis of the two approaches should go hand in hand; they should not be considered to be alternative.

²⁰⁹1961 Census figures.

17.19 *The Selective Approach.* The selective approach is specially suited to groups which can be easily identified, controlled and motivated for intensive literacy work. The specific needs of these groups can be ascertained and purposeful literacy programmes prepared to meet them. It is easier to handle such groups and investment on literacy for them can yield comparatively quick and gainful results. A further advantage of the selective approach is that the literacy programmes can include training which will advance the occupational and vocational interests.

17.20 By way of illustration, we suggest the following instances where selective programmes can be introduced immediately with great profit:

- (1) Industrial and commercial concerns employ a considerable work force of which about 40 per cent are non-literate. The problem is big enough to need attention. We recommend that all employers in large firms and commercial, industrial, contracting and other concerns should be made responsible, if necessary by law, for making their non-literate employees functionally literate within a period of three years of their employment. The responsibility of educating them should be squarely on the employers who should release them, in accordance with an agreed programme, for such education. They should also provide incentives to the non-literates and otherwise induce them to make a serious effort to learn. Government should bear all educational costs and supply the teachers, books and other teaching materials. We have no doubt that enlightened employers will find it of advantage in the long run to educate their workers.
- (2) We further recommend that the big industrial plants in the public sector should take the lead immediately and set the pace in this important programme.
- (3) All economic and social development plans have their human aspect and involve a large number of persons who have had no schooling. It is, therefore, logical that every development project in whatever field—industrial, agricultural, commercial, health, education or any other—should include, as an integral part, a plan for the education of its employees, more especially of those who are non-literate.
- (4) A series of schemes are launched by Government for economic betterment of the people and for social welfare. For instance, the Khadi production scheme of the Khadi and Village Industries Commission or the scheme of applied nutrition and child welfare programmes of the Community Development Department, involve several lakhs of women. We suggest that literacy programmes should constitute an essential ingredient of all such schemes.

These illustrations are by no means exhaustive. Planners of literacy programmes should be on the look-out to locate and develop others.

17.21 *The Mass Approach.* The essence of the mass approach lies in a determined mobilization of all available educated men and women in the country to constitute a force to combat illiteracy and an effective organization and utilization of this force in a well-planned literacy campaign. This approach is unorthodox but not untried. Whereas the selective approach is tied down by its inherent limitations and is by its very nature ineffective as an overall solution, the mass approach can achieve a real break-through. The mass approach was a remarkable success in the USSR. In a different way and on a smaller scale this approach was attempted in Maharashtra through the scheme of Gram Shikshan Mohim. The Mohim exploited the local village patriotism to eliminate illiteracy from the village and required the teachers and all local educated men and women to work for literacy. The scheme cost very little and its gains were much more than what could be measured in terms of literacy. Its critics have referred to certain inadequacies in the preparation for the Mohim and to weaknesses in the follow-up work. These defects can be remedied.

17.22 The responsibility for initiating a massive move to combat illiteracy goes beyond the capacity of the administrative and educational systems. It rests squarely upon the political and social leadership of the country. The success of this approach depends upon the strength of the conviction of those who are at the helm of national affairs, that illiteracy impedes national development as well as upon their ability to carry conviction to the people and to generate strong enthusiasm and motivation. We are convinced that if the nation is determined to make the country literate and to make the effort and sacrifice commensurate with the undertaking, India can become a literate nation within the foreseeable future.

17.23 Adult education is by nature a voluntary activity; the basic driving force is, therefore, the individual motivation of the adult. It may be clear to planners, educators and administrators that national security and integration, productivity and population control, health and general welfare of the people would improve through widespread adult education and training. This may not be so immediately apparent to the individual farmer or urban dweller that he would willingly sacrifice several hours in order to acquire such education. It is essential that the literacy programmes should be presented in ways which are meaningful to the adult and related in clear and understandable ways to the environment and to the conditions which he knows.

17.24 A mass literacy campaign depends largely upon the voluntary

services of all educated people, including government servants, employees in public organizations, lawyers, doctors, engineers and others. But the main brunt of the campaign will fall on the teachers and students in schools and colleges and considerable responsibility for organization will fall on educational institutions of all kinds. We recommend that the students in the higher primary, secondary, higher secondary, vocational schools and those in the undergraduate classes of the universities and colleges should be required to teach adults as a part of the compulsory national service programme which we have considered elsewhere.²¹⁰ It is equally necessary to require the teachers in schools of all types to teach and to participate in the campaign when they are called upon to do so. Work for adult literacy should be a part of their normal duty. In order to help them to do so it may be necessary either to give them relief from normal school work or to remunerate them for adult literacy work. Their services should be available for work connected with adult education whenever required. Every educational institution should be required to run literacy classes regularly and should be given responsibility for liquidating illiteracy in a specified neighbouring area the size of which should be determined by the size of the school staff and the number of students available for literacy work.

17.25 *The New Function of the School.* The new responsibility related to adult education will imply a significant change in the function and outlook of the school. The area of its main concern will not be confined to the school children; it will embrace the entire local community which it serves. It will be required to function as a centre of the life of the community. It will need to be transformed from a children's school to a people's school. It follows that it will need to be equipped and serviced as a centre of the community and an important base for extension services. It will require, among other aids, a library, radio sets, exhibits, posters, models and other materials necessary for adult education.

17.26 *Conditions Necessary for the Success of Literacy Programmes.* A word of caution is necessary. No adult literacy drive should be launched without prior planning and careful preparation. While we do not suggest that years of study and survey of every area are necessary before a programme is launched, we believe that attention to the more important points mentioned below will pay dividends and avoid frustration:

- (1) Before a programme is launched, all political, social and other leaders as well as all government departments should be involved in awakening interest and mobilizing support for it.
- (2) The adult non-literates to be enrolled in the programme should

²¹⁰Vol. I, Chapter I, and Vol. II, Chapter VIII.

be psychologically prepared and motivated for it. They must be made to realize what literacy would mean to them and feel convinced that such effort and sacrifice as they make will be worth while.

- (3) The widest use should be made of the mass media of communication for awakening and sustaining the people's will to learn and for giving them general support throughout the operation of the programme and after. The radio, television, films, the spoken word, and all other media should be utilized for creating and maintaining an atmosphere which will be conducive to the success of literacy work.
- (4) The material required for adult education programme should be prepared well in advance and should be available in sufficient quantities when the campaign is launched. These should include textbooks and other reading material, charts, maps, guide books and other instructional material and aids for the workers.
- (5) Literacy programmes should be carefully planned with due regard to local conditions and requirements. In addition to imparting skills in reading and writing, they should help to improve knowledge and skills relating to the profession of the non-literate adult; make him aware of the important problems of the community, his country and the world and of the need for active participation in important national programmes such as population control and give him some understanding of the life and culture of the country.
- (6) Literacy programmes should lead the neo-literate to continuing education. Literacy succeeds best when a person learns to use his knowledge to solve his problems through self-effort and to profit by the avenues to further knowledge such as schools, libraries and museums. A well-designed follow-up plan is an essential part of literacy programmes.
- (7) It should be clearly realized that literacy programmes, as we visualize them, cannot be left to the teachers alone. The work of teachers should be supported by:
 - (a) extension services of the universities and of such departments as industries, agriculture, public health, cooperatives and community development. These extension services should mainly help to improve knowledge, skills and practices related to the professions of the people; and
 - (b) mass media of communication and more particularly All India Radio should be used for awakening the consciousness of the adult non-literates towards their responsibilities to civic life and to vital programmes of national development.

- (8) The effects of literacy programmes will be short-lived unless they are supported by the establishment of libraries and a continuous supply of good reading material and newspapers.
- (9) A carefully thought-out plan of action should envisage the training in advance of the local leadership including civic and other authorities. Those involved should be acquainted with the details of the action planned and with the specific role they are required to play in carrying it out.
- (10) Students and educated persons who volunteer to teach should be given a short training in the methods of teaching and dealing with the adults. They should also be provided with guide-books and other helpful material.
- (11) An efficient machinery for administration and supervision is needed and should ensure involvement of voluntary agencies and support of vigilant evaluation and research.
- (12) Planning for literacy must visualize the activities which should continue after the intensive literacy campaign concludes. Those involved in the literacy programmes should be encouraged to help one another to continue to learn and, to this end, constitute study groups, associations, clubs or recreational groups.
- (13) Public commitment, support and enthusiasm are vital to the success of the literacy programmes. Public appreciation of the success of the programme, its concern when the activities slow down, its participation in improving its procedures, its encouragement of those who do outstanding work are all factors of extreme importance. Public involvement and support should be kept alive with the help of newspapers, leaders of social and political life, of learned societies, and other agencies.

17.27 Literacy for Women. The state of literacy among women is particularly distressing. The Census of 1961 showed that 34.5 per cent of the women in urban areas and only 8.9 per cent of them in rural areas were literate. It is universally acknowledged that unless women become educated, there is little hope for social transformation. Yet, efforts to make adult women literate are negligible. We cannot too emphatically recommend the urgency of initiating bold, imaginative and effective measures for stepping up literacy among women, particularly those in the rural areas. It is unnecessary in this Report to consider at any length what factors hinder operation of literacy programmes among women. It is well known that motivation to learn among women is weak; the social environment tends to be hostile for organizing literacy campaign among women; the women themselves have little leisure and they certainly cannot count on hours when they will be free to learn. The

most difficult problem is to find teachers for women. Some of the difficulties will be solved by the suggestion we have made for employing school children to teach; children could be made to deliver education to women at their door step at hours convenient to them. There would be little social objection to the 'little teachers' visiting homes for teaching women.

17.28 It is hoped that more and more women teachers will be appointed in schools and that they will be specially made to undertake the responsibility of teaching non-literate women in areas served by the schools. We see great potentiality in the scheme launched by the CSWB to provide 'condensed courses' to women whose education remained incomplete and to give them further training in some field such as teaching and nursing. We also suggest appointment in the villages of 'village sisters' for teaching village women and organizing adult education among local women. As far as possible, the 'village sister' should be a local woman, paid a small salary to do adult literacy work. She should be trained and periodically retrained to keep her informed of the new techniques of adult education work. In the urban areas, it should be possible to utilize government pensioners and retired persons for literacy work among women.

17.29 *Role of Radio, Television and Audio-visual Aids.* We have taken the view that the existence of the vast masses of non-literate and uneducated persons seriously handicaps national life and growth and that, therefore, their education cannot wait without peril. It is also apparent that illiteracy is slow a-dying and that with the best of national efforts and sacrifices, full literacy may require even two decades to be achieved in some parts of the country. Moreover, it is realized that it takes time to be able to use literacy; to select what to read and to comprehend what is read. Even those who have had fairly long formal education require educational maturity to make good use of the ability to read. However, education of the people should not wait till they become literate; it should precede, accompany and follow the programmes of literacy. To this end we have recommended fullest exploitation of the mass media of communication and films and other audio-visual aids. In fact the cinema, radio, wall posters, pictures and the like are already educating the non-literate and the literate alike. The choice is not between education and no education but between education which is necessary for national growth and integration and that which is given just to please and to recreate. The mass media of communication should be effectively used as a powerful instrument for creating the climate and imparting knowledge and skills necessary for improving the quality of work and standard of life of the people. In this connection we had contemplated re-

cording comprehensive recommendations for utilizing the services of radio and television for adult education. Our task, however, has been considerably lightened by the report of the Committee set up by the Ministry of Information and Broadcasting under the chairmanship of Shri A. K. Chanda.²¹¹ In appropriate paragraphs of this chapter we have referred to the special use which should be made of All India Radio and television for the various adult education programmes. We also generally support the recommendations made by the Committee on Broadcasting and Information relating to the role of radio and television in the field of adult education. We agree with the Committee that while television is a more suitable medium for adult non-literates, both television and radio can and should be used for carrying general education to comparatively less educated people and even to non-literates and that it should be used as a medium for improving production and for bringing about social transformation. In the conditions of modern life, radio, television and cinema have an important role to play in determining public attitudes and tastes. It is necessary, therefore, to use them for human and national good. There can be no better instrument for imparting useful knowledge to the masses of people and for making them understand what the country stands for and what it is struggling hard to achieve.

17.30 *The Follow-up.* All campaigns by their very nature must come to a close; but not literacy campaigns. The very purpose of the literacy campaign will be defeated if it did not continue in some form to keep the process of learning alive. The concern often expressed that there is a rapid relapse into illiteracy following a literacy campaign is justified by experience. The apprehension becomes greater when limited financial resources and lack of trained personnel make it necessary to employ voluntary services of students and teachers for teaching the non-literate. Retention of literacy acquired depends upon continued use of it for achieving some life purpose. We have suggested the urgency of creating motivation to learn as a preparation to the launching of literacy programmes. In fact, education of the people should begin with the help of mass communication media and other means to make people aware of the social, economic and political context of life. The need for literacy should be felt by the non-literate and he should realize what he misses without it. It is equally necessary that while he learns to read and write he should also learn what use he can make of his knowledge. Employment of students and educated volunteers for teaching non-literates is dictated by circumstances, but they can take the adults only very little ahead. They

²¹¹Report of the Committee on Broadcasting and Information Media, Ministry of Information and Broadcasting, New Delhi, 1966.

can impart knowledge of reading and writing and numbers and make the non-literate understand some problems of personal and civic life. After this initial stage, the teaching should be handled by regular teachers in schools and the neo-literates should be gradually led to the various forms of informal education which we discuss later. One of the main ingredients of literacy programmes should be to teach the adult to use the library both for pleasure and for profit. In substance we emphasize that, what is known as 'follow-up' programme is not different from literacy programme. The essential elements of the 'follow-up' work should be in-built in the literacy programme itself. It is a mistake to think that the activities grouped under the 'follow-up' procedures should be undertaken after the literacy campaign is over and adults have learnt to read and write. In the coherent whole of a literacy programme there should be elements which are necessary to make literacy enduring and useful. Literacy work once undertaken should merge into one or the other of the variety of forms of adult education and the process of learning once begun should be encouraged to continue.

17.31 We have suggested that planning for literacy and adult education programmes must include preparation of a variety of material which should be available whenever required. The most important material consists of textbooks and other books for the neo-literate and a variety of other literature, such as newsletters, magazines, pamphlets containing useful information relating to some aspects of agriculture or science or craft or any other matter of interest to the adult. Equally important is the preparation of guide-books and the production of literature which will be of help to the vast army of volunteer-teachers. It is also necessary to prepare charts, maps, models, films, filmstrips, and a vast variety of other audio-visual aids. The task is colossal and will demand considerable ingenuity and organization. If material is not ready, literacy programmes will be held up. It will never be too early to take up this earnestly and produce at least the books for the non-literate and their professional and non-professional teachers. Linguistic considerations and the magnitude of the demand in each language would indicate the need for setting up a competent production unit in each State. Treatment of the local problems and matters of local interests should make the books interesting. There should, however, be inter-State co-operation in order to ensure that the literature produced furthers national policies and strengthens national integration and patriotic sentiment. Inter-State cooperation may also help in certain cases to reduce cost of production. We feel that the Ministry of Education should take the lead and organize inter-State and inter-departmental cooperation for production of literature required for literacy and adult education programmes.

CONTINUING EDUCATION

17.32 *Significance.* Illiteracy must in time disappear and the school system ensure against its recurrence. Adult education, however, has an enduring function in the national system of education. In conditions of rapid change and advancing knowledge, man must continue to learn in order to live a full life. Learning is the way of civilized living.

17.33 The principle is now well recognized that a modern system of education does not merely provide wide-spread full-time education of different types and at different levels; it includes a wide range of courses and forms of instruction which an adult outside the full-time school system needs for his personal, professional, social and other interests. Thus conceived, continuing education 'becomes the growing and the harvest for which formal schooling is only the planting and the cultivation'. It is no wonder that in advanced societies adult education tends to become the fastest growing segment of education.

17.34 *General Recommendations.* Broadly speaking, the system of continuing education should be designed to suit two different groups of people. The first of these consists of those who can join with others to form groups for part-time study in educational institutions or *ad hoc* classes of instruction in specific subjects organized by various agencies such as the departments concerned with development, or universities, boards of secondary education or institutions for technical, vocational or agricultural education, or learned societies and voluntary organizations. The second is composed of those who must study at home during such hours as they can find for the purpose, but who require assistance to be delivered to them at their convenience. Adult education must be designed to serve a great variety of purposes and different groups which vary not only according to their educational attainments but according to their occupational interests, cultural aspirations and sensitiveness to responsibility in public affairs. We have earlier referred to those who had to leave schooling before completing the primary stage of education and suggested they should be enabled to complete the stage. There are others who desire to go up the ladder of formal education leading to university degrees in various faculties including those of science, technology and agriculture. There are also those who are working on farms, workshops, factories, commercial houses as well as those who are self-employed, who need training for improving their efficiency. Even those engaged at high professional levels need to refresh their knowledge and become acquainted with the new thinking and practices in their fields of specialization. More particularly, teachers at all stages of education, including the university, must have opportunities of keeping themselves abreast

of the advancing frontiers of knowledge. This also applies to lawyers, doctors, business managers, industrial chiefs and others at the top of their professions. There are also those who wish to learn something just for the joy of it, for example, a foreign language, or painting, or music or interior decoration or cookery or flower arrangement or something else unconnected with their occupation in life. Adult education must be tailored to suit all tastes and needs. What is of significance is that good imaginatively designed courses covering a varied range of interests themselves serve as powerful media for creating incentives to learn.

17.35 We recommend that educational institutions of all types and grades should be encouraged and helped to throw open their doors outside the regular working hours to provide such courses of instruction as they can to those who are competent and desirous of receiving education. This is the approach which is favoured throughout the world; but in the conditions of our country its acceptance is acutely necessary because the circumstances of history have forced many to begin life without proper education or training. We thus suggest the creation of a parallel system of education for those who can attend educational institutions only during a few hours they can spare in the evenings or at other convenient times in order to enable them to qualify for the same certificates, diplomas and degrees as those for which the regular students in the educational institutions work. We are aware of the recent development of the evening colleges in several parts of the country. We hope that the evening colleges in several parts of the country will provide good education in an atmosphere which will encourage learning rather than merely serve to enable those outside the regular system to purchase eligibility to appear at the examinations by a nominal recording of attendance. Not only the secondary schools and colleges but all institutions and more particularly the vocational, technical and agricultural institutions should provide part-time education outside their regular hours.

17.36 Educational institutions should also give the lead in organizing *ad hoc* short courses which will help people to understand and solve their problems and to acquire wider knowledge and experience. Short courses in soil management, use of fertilizers, poultry farming, orchard growing, care of children, nutrition, and nursing could be cited as illustrations. The scope of such activities is unlimited, provided there is proper planning and cooperation of the departmental machinery of government, the universities, colleges, technical institutions and local leadership. It is not enough that such courses should be organized; it is more important to create motivation to learn among the people and to organize groups interested in different courses.

17.37 *Education of Industrial Workers.* We have already emphasized the urgency of selective approach to educate the workers in organized industries and suggested that they should be made literate within three years. We have also suggested that their education should be a cooperative endeavour of the employers, who should provide time and other amenities and incentives and of education departments which should prepare programmes for education and provide teachers, books and other assistance. In view of the important role which the working classes play in improving production, their education should not be allowed to end after they have become functionally literate. We, therefore, recommend that further education should be provided for workers for improving their knowledge and skills, widening their horizon in life, inculcating in them a sense of responsibility towards their profession and improving their careers. Special part-time and sandwich courses should be offered for them which would lead them step by step to higher courses.

17.38 In this connection a crucial measure will be to institute special courses for the industrial workers which would be comparable in quality and standard with those for the high and higher secondary courses for the regular school students. It is necessary to recognize the marked distinction between the ages, attitudes and aspirations of the comparatively grown-up, realistic and practical workers in the factories and the care-free adolescents in the schools who are not attached to any specific occupation in life. This distinction tends to wear off with age as the products of the school move into institutions of higher education; but its unique significance at the secondary level should be expressed in terms of the differentiated part-time and correspondence courses for the workers which should stress their mature needs and special occupational and other interests.

17.39 An immediate beginning should be made in this direction by the Central Board of Secondary Education. Industrial plants in the public sector should also take the lead in organizing classes for workers and encouraging them to work for these examinations. Part-time courses would help the workers still further through specially designed programmes to attain as high standards as possible in various fields of general, technical, managerial and other types of education with which the future of the worker is concerned.

17.40 Education of the workers should be the joint responsibility of the Ministry of Education and the Ministry of Labour and Employment. The organizational aspect of education for industrial workers should be the responsibility of the Ministry of Labour and Employment which should arrange classes of different groups, release the workers for receiving education at reasonable hours, provide amenities such as classrooms, libraries, reading rooms, and laboratories where possible and above all

offer incentives to those who show good progress. The Ministry of Education should organize preparation of different types of programmes and courses required for industrial workers in consultation with the Ministry of Labour and Employment, employers, universities, board of secondary education and those in charge of technical education. The Ministry of Education should also provide teachers, textbooks and other amenities and should obtain for the education of the workers such assistance as the neighbouring institutions for general and technical education can provide.

17.41 Adult education for the industrial workers should be designed with the utmost care and with a sense of purpose. Efforts should be made to avoid imbalance observed in some of the existing programmes which either lay almost exclusive emphasis on the working of trade unions, labour policies and the like or on literacy and recreational activities. The main function of these programmes should be to equip an increasing number of workers with higher technical and vocational qualifications so that they can rise to positions of responsibility within the industry. Thus viewed, the education of workers cannot be considered in isolation from the main streams of general, vocational and technical education. As we have emphasized elsewhere, schools for general and vocational education, colleges, boards of secondary education, universities and technical institutions should undertake increasing responsibilities for the education of the industrial workers.

17.42 *Special Programmes and Institutions.* It is not possible for the part-time courses in school and college systems to cover all the varied needs of adult education since some of them will require special institutions. For example, our attention has been drawn to the valuable work done by the institutions brought into being by the CSWB which provide 'condensed courses' to train partially educated women for a variety of social services and thus rescue them from helpless unemployment. We have already suggested the urgency of training as large a number of women as possible for working as 'village sisters', teachers, nurses and other social workers. It follows that centres for condensed courses should be multiplied and selected educational institutions such as colleges, high schools and teacher training institutions should be strengthened with staff and other requirements to provide this training. We have also been impressed by the account given to us of the rural institutes and institutions like the Vidyapeeths in Mysore State. The Vidyapeeth functions in some ways like the folk high schools of Denmark and provides general as well as practical education to selected groups of the rural people brought into residence for short periods. Education in these institutions is, as it ought to be, production-oriented and lays emphasis on agriculture and rural crafts. Some of the rural institutes provide brief

courses to groups of chairmen and office-bearers of village panchayat samitis in order to help them to appreciate the responsibilities of their office and the democratic procedures which govern all civic decision-making. We suggest that the working of the Vidyapeeths and the rural institutes should be frequently reviewed in order to enable them to be of service to the rural community. The staff for such institutions must be of the highest quality and very specially trained. It is necessary that these institutions should work in close collaboration with agricultural demonstration farms and centres for extension services. More such institutions are necessary; but the expansion should be limited to availability of competent staff and other supporting services.

17.43 Organization of part-time courses for adults brings added responsibilities to the educational institutions and it is obviously the responsibility of Central and State Governments to ensure that the institutions have the necessary requisites to discharge these new functions. The institutions must have extra staff for the new services which they are required to render, adequate supply of books, teaching materials and aids, libraries and laboratories. The methods of teaching part-time students would be different and the fullest advantage should be taken of the fact that they will have strong motivation to learn. It is equally important that there should be no relaxation of standards to help them. If necessary, the duration of the courses should be lengthened somewhat to make it easier for the part-time students to pursue them.

CORRESPONDENCE COURSES

17.44 There must also be a method of taking education to the millions who depend upon their own effort to study whenever they can find time to do so. We consider that correspondence or home-study courses provide the right answer for these situations.

17.45 The correspondence or home-study course is a well tried and tested technique. Experience of correspondence courses in other countries of the world, such as the USA, Sweden, the USSR, Japan and Australia, where they have been used extensively for a long time, as well as the limited and brief experience at the University of Delhi, encourage us to recommend fuller exploitation of the method for a wide range of purposes. There is hardly any ground for the apprehension that correspondence courses are an inferior form of education than what is given in regular schools and colleges. Experience abroad and experiments in India have shown results which, on balance, tend to strengthen the case for correspondence education.

17.46 The home-study method no doubt lacks the inspiring contact with the teacher. But inspiring teachers are rare, and in correspondence

study the adult has a strong motivation to learn. The method also establishes a personal and private relationship with the teacher which encourages discussion and understanding through written communication thereby ensuring relevancy and precision. In fact, there can be no effective education through correspondence without this private and purposeful relationship between the student and the teacher, whereas in many indifferent and over-worked schools and colleges there is hardly any worthwhile contact between the teacher and the taught. The mere fact that the major effort to learn has to be made by the student himself in the correspondence method and that he is required to do a variety of exercises and tests in writing, which are guided and supervised, substantially support the educational value of the method.

17.47 Correspondence courses should not mean mere exchange of written instructions and exercises. One essential aspect of the method is that the teachers and the taught meet occasionally even if it be for a brief while and participate in specially devised programmes which include lectures, seminars and group discussions. Those studying science or technical subjects should have access to a laboratory and workshop during week-ends or in vacation time. A variety of other means can enrich correspondence procedures. Correspondence course students living in a locality and interested in common subjects can form self-study groups and help one another. It is essential that they should be given the status of recognized students, and where possible, they should be attached to some colleges and allowed the benefit of the use of the library and such other amenities as seeing educational films, listening to recorded speeches of distinguished scholars, and attending extension lectures.

17.48 Correspondence or home-study courses which are sequenced in accordance with the principles of programmed learning are of enormous benefit in certain fields of education. It has been pointed out that the programmed procedures give good results when a student is introduced to a new subject and required to grasp its fundamental concepts. We feel that it would be profitable to experiment with the application of the methodology of programmed learning in correspondence courses.

17.49 Correspondence courses should be supported by well-coordinated radio and television programmes. It is not possible at this stage to have a regular university of the air; but radio and television can illumine the more fundamental and sensitive themes in the different areas of study. We consider it necessary that the universities and other agencies dealing with the correspondence courses should join with the All India Radio and Television and prepare a variety of radio and television programmes which will be of value to those who are studying through correspondence courses. A good beginning can be made by 'broadcasting' specially prepared talks and discussions on the more important

themes of the correspondence courses organized by the Delhi University.

17.50 Correspondence courses should not be confined merely to helping students to prepare for university degrees. Important programmes of correspondence courses could be organized to provide suitable courses of instruction in subjects which will help the workers in industries, agriculture and other fields to improve production. Some of the subjects in which courses can be organized are landscaping and gardening, architecture, plumbing, diesel engine, drafting, engineering, business administration, building construction and blueprint reading, surveying, firemanship, mathematics, sheet metal, auto mechanics, commercial art, electronics, radio, television servicing and broadcasting, auxiliary nursing, vocational rehabilitation subjects, industrial electronics and automation, dress-making, business and secretarial subjects, air conditioning, heating, refrigeration, criminal and civil investigation, traffic management, hotel management, factory management and executive training, airline training, photography, professional locksmithing, upholstery and real estate.²¹² Good correspondence courses in thoughtfully identified fields of service will create demand for themselves and can help participation by the people in introducing better methods of production.

17.51 Correspondence courses should be available for those who desire to enrich their lives by studying subjects of cultural and aesthetic value such as languages, philosophy, history, politics, economics, art appreciation, literary criticism, psychology and the like. These subjects indeed bake no bread, but while they do not directly assist economic growth they help to improve intellectual and aesthetic standards and to transform the outlook on life.

17.52 It is obvious that these universities should not be the only agencies which should organize correspondence courses. Provision of correspondence courses should also be one important function of the extension service of developmental departments of government such as agriculture, industries, cooperation, health. This should prove to be a valuable method of conveying to the educated and the neo-literate alike such knowledge and improved techniques as the departments concerned wish to put across.

17.53 We also recommend the institution of special programmes of correspondence courses for teachers in our schools in order to keep them abreast with the new knowledge in the subjects they teach as well as with the new methods and techniques of teaching. This measure is particularly necessary in the depressing background in which teachers have to work in schools in which library facilities are poor and where

²¹²See Chapters XIV and XVI.

there is little intellectual communication. It would also help teachers to feel secure about what they teach and perhaps inspired by the new challenges.

17.54 The Ministry of Education in collaboration with other Ministries should establish a National Council of Home Studies. The Council should be authorized to assume many functions including accreditation and evaluation of agencies. It should identify areas in which different types of correspondence courses would be of benefit and establish them on their own or assist Government departments, universities, boards of education, institutions of technical education and private agencies to create them. It should also carry out continuous evaluation of the various programmes of education through correspondence.

17.55 Some controversy surrounds the costs of correspondence courses. One view maintains that correspondence programmes cost as much as, if not more, than regular education in schools, colleges, and other institutions. Another view holds that as large numbers are involved in correspondence courses, it should certainly cost much less than regular education in residence. It is not easy to compare the costs in different countries because the assumptions vary. However, it is worth pointing out that supervisory staff requirements do not rise relatively to the increase in numbers and the advantage of superior staff reaches a very wide range of students. The student works and earns while he studies and if he is a productive worker, he continues to help production. If his correspondence course helps to improve his knowledge and skills relating to his occupation, he will be better able to do his job. For him there need be no separate building and equipment, no playgrounds and gymnasias, no hostels and special tuitions, no special libraries or laboratories.

17.56 We also recommend that it should be possible for private candidates—whether employed or not—to take any or all of the examinations conducted by the secondary education boards and universities in the country. Many serious-minded adults (or even young persons), and particularly girls and women, are unable to take these examinations conducted by the secondary education boards and universities in the country, because they are unable to fulfil the usual conditions relating to attendance. There is no reason why they should not be encouraged to depend on their own effort to prepare for these examinations.

LIBRARIES

17.57 We have referred to the need of libraries in different parts of this chapter and we think that a good library system which brings books

within the reach of all is the backbone of the system of adult education. Without this there is little hope for cultivating reading habits among adults particularly in rural areas, where book distribution is difficult. The Working Group of the Planning Commission has recommended a scheme for large-scale establishment of libraries in the country. We generally agree with its recommendations.

17.58 We also accept the major recommendations of the Advisory Committee on Libraries (1957) relating to the establishment of a network of libraries throughout the country, including a National Central Library at Delhi, Regional Libraries in Bombay, Calcutta and Madras, a State Central Library in each State, and libraries at the district, block and panchayat levels. This would form the framework which would sustain widespread library growth and organized services throughout the country.

17.59 School libraries should be integrated with the system of public libraries. We have laid stress on schools being made centres of adult education and extension services. It is, therefore, necessary to develop and assist school libraries to perform this new function. Even the remotest primary schools should be serviced by a neighbouring public library.

Libraries will need reorientation in order to function as media of adult education. They will need to be stocked with reading material which will lead the neoliterate step by step from simple but interesting reading to more advanced books giving information of value to him. Libraries will also require books and other reading material which will have a bearing on the practical needs and tastes of the adults. Wherever possible, libraries should have stocks of tape records, gramophone records, and films and other useful aids. The libraries will also be used by those who take part-time education, those who take correspondence courses and those who depend on their own efforts. It is necessary that their needs should find a place in the equipment of libraries.

17.60 Libraries should not remain, as they tend to do, mere store-houses of books; they should be dynamic and set out to educate and attract adults to use them. There are many known ways of performing this function. One which conforms to the age-old traditions of adult education in the country is collecting an audience for hearing some book or poem of interest read out. Lectures, discussion groups, book-clubs should be initiated and attempts made to make the library a centre of interest for the community. By way of illustration we refer to the useful work done by the Delhi Public Library which has not only encouraged people to become book-minded but has endeavoured to make the library a dynamic centre of a variety of cultural activities.

THE ROLE OF UNIVERSITIES IN ADULT EDUCATION

17.61 *Significance.* The image of the university as a closed academic community of scholars creating and disseminating knowledge and perpetuating its own type is a thing of the past. The walls which divide the gown and the town have crumbled and the life of the university and that of the community can be vitally linked for their mutual enrichment.

17.62 This change of attitude is noticed in a marked way in some of our universities which have organized correspondence courses, extension lectures and seminars for the benefit of extra-mural students. The correspondence courses introduced by the University of Delhi have already created a demand for more such courses. The establishment of the Department of Adult Education by the University of Rajasthan is a welcome move and much is expected of it. We feel that the universities in our country must take upon themselves a much larger share in the responsibility for educating adults.

17.63 *Programmes.* The function of the university is to help the social, economic, educational and cultural growth of the community which it serves. With its specialized agencies it can create a wholesome impact on certain sensitive areas of economic, social and cultural life of the people. One significant way in which it can give a lead is to communicate to the people the new scientific findings and new thinking on social and economic problems. Similarly, universities can effectively undertake a variety of programmes for re-education of the key personnel of the different professions. In this context, a special mention of re-education of the teachers is relevant. The need is so urgent and the problem is so vast that the country would naturally look to the universities for effective leadership for re-educating the teachers and keeping them fully informed of the new teaching practices and methods, new philosophies of education as well as developments in the various fields of knowledge with which they are concerned. They can also help in building up healthy attitudes of the community towards some of the fundamental national problems, such as those of public health, sanitation, population control, and building up of national solidarity. The universities should also organize programmes which will brief the national leadership in civil and political life as well as the people and acquaint them with knowledge and wider experience pertinent to decision-making on some of the vital problems challenging national life. They should also help to raise the standard of national tastes as well as habits of life and social behaviour of the people. There is no end to the good which the university can do to the community. It is, however, necessary that each university should measure its own opportunities and plan the best that it can do to be of service to the society which it serves. We have already referred in other

parts of this chapter to what universities should do to assist eradication of illiteracy from the country and training of the leadership for the purpose.

17.64 The universities alone can think out the ways in which they can organize their services to the community in accordance with the means at their disposal. It is usual to organize evening classes for adults who are employed during the working hours and to prepare them for university examinations. The organization of special study groups and short-term special courses for professional benefit is also urgently needed, as well as a variety of extension programmes, including lectures, field work, demonstrations, and cultural and recreational activities. Universities should in addition organize social service camps and adopt villages for intensive programmes for development and eradication of illiteracy as well as for maintenance of schools and other similar social services, the improvement of agriculture, local industries, and working of cooperatives. Here again, there is no end to the ways which a university can adopt for making their extension service effective.

17.65 *Administration and Finance.* The universities should have an efficient machinery for launching carefully planned adult education programmes and for evaluating achievements. We suggest the establishment in each university of a Board of Adult Education which will include representatives of all departments involved in preparing and executing adult education programmes. The vice-chancellor should be the chairman of the Board. It should lay down policies as well as plan programmes and direct their operation jointly by the various departments of the university. It should also evaluate the success of the programmes. We also feel that some universities in the country should develop full departments of adult education. The purpose of such departments should be to train specialists and teachers in the field of adult education, to undertake and to guide research in all problems connected with adult education in cooperation with other relevant departments such as education, sociology, and psychology and to cooperate with the proposed Board of Adult Education in producing inter-departmental programmes of extension service and helping in their fulfilment.

17.66 Needless to say, the universities should be specially financed and equipped for the purpose of the adult education work which they undertake. The normal resources of the university will be inadequate in initiating extension services. It is true that most of the work will be done on a voluntary basis but universities will require some additional staff and special libraries, which will include films, tape libraries, audio-visual aids, suitable transport, camping equipment and other educational aids. We are convinced that the assistance given to the universities to organize adult education programmes will be fully rewarded.

ORGANIZATION AND ADMINISTRATION

17.67 We have already seen that one of our major weaknesses in work in the field of adult education in the past has been the absence of an overall plan and of coordination of efforts by different governmental and voluntary agencies.

17.68 *National Board of Adult Education.* To overcome these defects, the Report on Social Education of the Committee on Plan Projects recommended the establishment of a Central Board of Social Education. The National Seminar on Adult Education held at Poona in 1965 recommended the creation of a National Board of Adult and Literacy Education. We recommend the setting up of such a National Board of Adult Education on which all relevant Ministries and agencies would be represented. The initiative for its creation may be taken by the Ministry of Education. Its functions would be:

- (1) To advise Governments, at the Centre and in the States, on all matters relating to informal adult education and training and to draw up plans and programmes for their consideration;
- (2) To promote the establishment, where needed, of agencies and services for the production of literature and other teaching material and for the needed training programmes;
- (3) To ensure coordination among different Ministries and official and non-official agencies;
- (4) To review from time to time the progress made and to formulate suggestions for change and improvement; and
- (5) To promote research, investigation and evaluation.

Similar bodies should be set up at the State level. Committees at the district level, acting as wings of Zila Parishads where these exist, should also be set up, supported by *ad hoc* committees of block and village panchayats. At the village level, the schools should be developed as community centres. At the village, block and district levels, close co-operation with agriculture, health, cooperative, community development and other extension programmes must be ensured.

17.69 *Adult Education—a Total Governmental Function.* We wish to lay stress on the fact that the pluralism of adult education and its wide and varied range, preclude it from being regarded as the sole concern of a single department in a Ministry which handles it administratively. It is necessary to recognize it as a business of every department, and the entire administrative machinery not only at the planning but also at the implementation levels must be involved in the preparation and unfolding of its programmes. The functioning of adult education cannot admit

of departmentalism and we have been told that the work in the field has suffered to no small extent because of its rigid administrative aloofness. It is true that adult education is mainly the function of the Ministry of Education but it is necessary to adopt procedures which will ensure practical involvement of the entire administrative machinery.

17.70 *Voluntary Agencies.* Voluntary agencies working in these fields should be given every encouragement, financially and technically. Adult education is an area ideally suited to voluntary effort and the work to be done is of such dimensions that the mobilization of this will play a crucial role in the success of our plans.

SUMMARY

1 *Liquidation of Illiteracy.* (1) Every possible effort should be made to eradicate illiteracy from the country as early as possible and in no part of the country, however backward, should it take more than 20 years. The national percentage of literacy should be raised to 60 by 1971 and to 80 by 1976.

(2) As a first step to arrest the growth of illiteracy, the following measures should be taken:

- (a) Expansion of universal schooling of five years' duration to the age-group 6—11;
- (b) Provision of part-time education to those children of age-group 11—14 who either miss schooling or drop prematurely out of the school;
- (c) Provision of part-time general and vocational education to the younger adults of the age-group 15—30.

(3) For the liquidation of illiteracy a two-fold strategy comprising the selective approach and the mass approach should be adopted.

(4) Under *selective* approach, programmes should be adopted for specified groups of adults which could be easily identified, controlled and motivated for intensive literacy work. All employers in large farms and commercial, industrial, contracting and other concerns should be made responsible, if necessary by law, for making their employees functionally literate within a period of three years of their employment. Big industrial plants in the public sector should take the lead immediately and set the pace in this important direction. Every development project should include, as an integral part, a plan for the education of its employees, more especially of those who are non-literate. Literacy programme should constitute an essential ingredient of all schemes launched by Government for economic and social developments.

(5) Under *mass* approach, all available educated men and women in the country should be mobilized for raising a force to combat illiteracy and utilize it in a well-planned literacy campaign. In the organization of mass campaign, the teachers and students and all educational institutions should be actively involved. The students in the higher primary, secondary, higher secondary, vocational schools and those in the undergraduate classes of the universities and colleges should be required to teach the adults as a part of compulsory national service programme. Teachers in schools of all types should be required to teach and participate in the campaign. Every educational institution

should be given responsibility for the literacy efforts in rural area. The school in particular should be treated as an integral part of **community life.**

(6) No literacy campaign should be launched without careful planning and preparation. The various aspects to be taken into account have been discussed in the Report.

(7) In order to promote literacy among women, special courses for women sponsored by the Central Social Welfare Board should be adopted; appointment of full-time staff should be made and for teaching village women and once started it should be continued in local communities.

(8) The mass media of communication should be effectively used as a powerful instrument for creating the demand for learning knowledge and skills necessary for improving quality of work and standard of life.

(9) In order to retain the literacy achieved, literacy campaigns must have adequate follow-up including further education, the use of library, and the production of reading material. 17.7-31

2 *Continuing Education.* (1) Educational institutions of all types and grades should be encouraged and helped to throw open their doors outside the regular working hours to provide such courses of instruction as they can to those who are desirous of receiving education. A parallel part-time system of education should be created to provide adults with opportunities for taking the same diplomas and degrees as students in schools and colleges.

(2) Educational institutions should give the lead in organizing *ad hoc* courses which will help people to understand and solve their problems and to acquire wider knowledge and experience.

(3) Further education should be provided for workers for improving their knowledge and skills, widening their horizon in life, inculcating in them a sense of responsibility towards their profession and improving their careers. Special part-time and sandwich courses should be offered for them which would lead them step by step to higher courses.

(4) Special institutions such as those run by the Central Social Welfare Board for Adult Women and the Vidvapeeths in Mysore State should be established. The existing institutions should be frequently reviewed in order to enable them to be of service to the rural community. 17.32-43

3 *Correspondence Courses.* (1) In order to bring education to those who are unable even to attend part-time courses, widespread organization of correspondence courses should be organized.

(2) Students taking correspondence courses should be provided opportunities to meet the teachers occasionally; they should be given the status of recognized students, and where possible be attached to some colleges in order to enable them to make use of the library and other facilities.

(3) Correspondence courses should be supported by well-coordinated radio and television programmes.

(4) Correspondence courses should not be confined to preparing students for the university degrees but should also provide agricultural, industrial and other workers such special courses of instruction as would help them to improve production.

(5) Correspondence courses should be made available for those who desire to enrich their lives by studying subjects of cultural and aesthetic value.

(6) Correspondence courses should be developed for the teachers in schools to keep them abreast with new knowledge as well as with new methods and techniques of teaching.

(7) The Ministry of Education in collaboration with other Ministries should establish a National Council of Home Studies, for the purpose of accreditation and evaluation of agencies which provide correspondence courses, identification of the areas in which different types of correspondence courses would be of benefit, promote creation of such courses through proper agencies, and conducting evaluation and research.

(8) Opportunity to take examinations conducted by the Secondary Education Board and Universities in the country should be made available to those who wish to work on their own without any assistance.

17.44-56

4 *The Libraries.* (1) The recommendations of the Advisory Committee on Libraries relating to the establishment of a network of libraries throughout the country should be implemented.

(2) School libraries should be integrated in the system of public libraries and be stocked with reading material of appeal both to children and neo-literates.

(3) The libraries should be dynamic and set out to educate and attract the adults to use them.

17.57-60

5 *Role of Universities.* (1) The universities in India should assume a much larger responsibility for educating the adults. Some of the important programmes which the University could undertake are described in paragraphs 17.62 and 17.63.

(2) In order to have an efficient machinery for launching carefully

planned adult education programmes, each university should establish a Board of Adult Education with representatives from all departments involved in adult education programmes. Universities should also set up Departments of Adult Education.

(3) Universities should be financed and equipped for carrying out the adult education work. 17.61-66

6 *Organization and Administration.* (1) A National Board of Education on which all relevant Ministries and agencies would be represented should be established. The functions of the Board are stated in paragraph 17.67. Similar bodies should be set up at the State and district levels.

(2) Voluntary agencies working in the field of adult education should be given every encouragement, financial and technical. 17.67-70

APPENDIX I

AN EXPLANATORY NOTE ON ENROLMENT STATISTICS INCLUDED IN THE REPORT

(Prepared by Shri D. L. Sharma under the guidance of the Member-Secretary)

AI.01. The object of this Note is to explain the basis of compilation for the enrolment statistics included in this Report.

AI.02. The organization of the educational system, as visualised by the Education Commission, has been explained in detail in Chapter II. The manner in which the existing structure in the different States at the school stage is equated with this proposed structure, is shown below.

TABLE AI.1

EQUIVALENCE OF CLASSES I-X AT THE SCHOOL STAGE (1965-66)

X		X		XI		X
IX		IX		X		IX
VIII		VIII		IX		VIII
VII		VII		VIII		VII
VI		VI		VII		VI
V		V		VI		V
IV		IV		V		IV
III		III		IV		III
II		II		III		II
I		I		II		I
Pre-Primary Education		B		I		
		A				

As proposed by the
Education
Commission

Group A
Assam
Nagaland
NEFA

Group B
Andhra Pradesh
Bihar
Gujarat
Madras
Maharashtra
Orissa
Dadra & Nagar
Haveli
Goa, Daman and
Diu
Pondicherry

Group C
Jammu & Kashmir
Kerala
Madhya Pradesh
Mysore
Punjab
Rajasthan
Uttar Pradesh
West Bengal
A & N Islands
Delhi
Himachal Pradesh
L.M.A. Islands
Manipur
Tripura

(ii) EDUCATION AND NATIONAL DEVELOPMENT

Explanatory Note. (i) The chart given above shows the position in 1965-66. It has varied from time to time. In tabulating enrolment, the position as it was in the year concerned, has been adopted.

(ii) There is no public examination at the end of Class X in Madhya Pradesh, Delhi and A. & N. Islands. But the higher secondary examination in these areas, which is held at the end of Class XI, leads to the three-year degree course. We have, therefore, equated Class X in these areas with the class leading to the high school examination in other States.

AI.03. In the school stage ending with the high school, the total duration of schooling is 12 years in one group of States and Union Territories, 11 years in another group, and 10 years in the third group.

AI.04. The central point in this proposal is to treat the public examination at the end of the high school stage (which is Class X in some States and Class XI in others) as equivalent and to go downwards, equating each successive class in school education and also upwards, equating each successive year in higher education.

In the enrolment statistics given in the Report, the equation of school classes is as follows.

TABLE AI.2

Class in the Commission's Report				Equated with
Pre-Primary Stage	..	..	..	Infant A and B in Group A, Class I in Group B and Pre-Primary (not shown in the chart) in 1 State.
<i>Class</i>				
I	..	..	..	Class I in Groups A & C and Class II in Group B.
II	..	..	..	Class II in Groups A & C and Class III in Group B, and so on.
X	..	..	..	Class X in Groups A & C, and Class XI in Group B.

AI.05. The equivalence in higher education courses (arts and science) has been shown in the chart given below.

TABLE AI.3

EQUIVALENCE IN HIGHER EDUCATION
(1965-66)

(a)	(b)	(c)	(d)	(e)	(f)	(g)
First Degree	III	III	A	III	III	III
	II	II	II	II	II	II
	I	I	I	I	I	I
Higher	XII	II	XII	A	A	A
Secondary	XI	I	XI	XI	XI/XII/ PUC	PUC

(a)	(b)	(c)	(d)	(e)	(f)	(g)
	As proposed by the Education Commission	Kerala (The first two years belong to Junior Colleges)	U.P.	Madhya Pradesh A & N Islands Delhi	Andhra Pradesh Assam Bihar Jammu & Kashmir Madhyashira Mysore Panjab Rajasthan West Bengal Himachal Pradesh Mizoram N.I.F.A. Tripura	Gujarat Madras Nagaland Orissa Goa, Daman, and Diu Pondicherry

Explanatory Note

- (i) Columns marked 'A' show the year to be added by 1986.
(ii) The chart given above shows the position in 1965-66. It has varied from time to time. In tabulating enrolment, the position as it was in the year concerned has been adopted.
(iii) PUC=Pre-University Course.

AI.06. *Pre-Primary Education.* In our statistics, pre-primary education includes enrolments in the following three categories:

- (1) Pre-Primary classes proper
- (2) Infant A Class
- (3) Infant B Class in I Class I (where it corresponds to the Infant B Class).

AI.07. In each year of tabulation the corresponding enrolments in all the States and Union Territories which had the categories mentioned above have been aggregated together and given in Table AI.4

AI.08. *General School Education.* (Classes I—X). Enrolment in Classes I—X as aggregated by us, includes Classes II—XI in those States where the school stage is spread over 11 years and Classes I—X in all the other States. The retabulated enrolments are given in Table AI.5.

AI.09. *Basis of Estimating Enrolments at the School Stage in 1965-66.* The total enrolments at the school stage for 1965-66 were assumed to be the same as given by the Planning Commission. In breaking down these enrolments class by class, however, it was assumed that owing to the reduction of wastage and the increasing desire to stay longer at school the proportion of the enrolment in higher classes to the total enrolment at the school stage will be a little better in 1965-66 than in 1960-61. Table AI.6 shows the actual proportion of the enrolments in each class to the total enrolment at the school stage for the years 1950-51, 1955-56 and 1960-61 (on the new pattern of aggregation adopted by us). It also gives the assumptions made by us regarding this proportion for 1965-66.

AI.10. *General School Education (Classes XI and XII).* In tabulating enrolments in general school education in Classes XI and XII, the enrolments in the following categories were included:

- (i) Class XI of the higher secondary schools in all the States which have adopted the higher secondary pattern.
- (ii) The pre-university class.
- (iii) Intermediate classes (1st and 2nd year) in U.P. except the second year in the Universities of Aligarh and Banaras which have adopted the three-year degree course.
- (iv) The first year of the Intermediate class in all the other States which have now adopted the three-year degree course (the second year, where it existed, has been shown in the undergraduate stage).

TABLE A1.4. ENROLMENT IN PRE-PRIMARY EDUCATION (1950-51 TO 1965-66)

Class	(in thousands)											
	1950-51			1955-56			1960-61			1965-66 (Estimated)		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
Pre-Primary . . .	15	13	28	45	31	75	97	82	179	130	120	250
Infant A . . .	687	221	908	445	224	668	352	227	579	453	300	753
Infant B and Class I . .	2,675	1,566	4,241	4,108	2,283	6,391	4,932	2,922	7,855	6,563	4,207	10,770
TOTAL . . .	3,377	1,800	5,177	4,598	2,537	7,135	5,381	3,231	8,612	7,146	4,627	11,773

Source: Ministry of Education, Form A of the States concerned till 1960-61. The figures for 1965-66 were estimated in the Secretariat of the Commission.
N.B. Totals do not tally because of rounding.

TABLE AI.5. ENROLMENT IN CLASSES I-X, 1950-51 TO 1965-66

(in thousands)

Class	1950-51			1955-56			1960-61			1965-66 (Estimated)		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
I	3,750	1,466	5,216	4,808	2,137	6,945	6,401	3,127	9,528	9,057	4,827	13,884
II	2,664	939	3,603	3,149	1,295	4,443	4,383	2,026	6,409	6,246	3,210	9,456
III	2,101	686	2,788	2,450	934	3,384	3,534	1,538	5,073	4,888	2,546	7,434
IV	1,587	458	2,045	1,963	645	2,608	2,852	1,135	3,987	4,345	1,771	6,316
Total of classes I-IV	10,102	3,549	13,651	12,369	5,011	17,380	17,170	7,826	24,996	24,536	12,554	37,090
V	1,111	244	1,355	1,470	398	1,867	2,276	814	3,090	3,666	1,550	5,216
VI	873	184	1,056	1,215	304	1,519	1,819	601	2,421	2,897	1,151	4,048
VII	686	131	816	975	232	1,206	1,491	461	1,952	2,399	886	3,285
Total of classes V-VII	2,669	559	3,228	3,659	933	4,592	5,587	1,876	7,463	8,962	3,587	12,459
VIII	581	91	672	790	163	953	1,191	320	1,511	1,856	620	2,476
IX	378	54	433	630	120	751	920	220	140	1,494	421	1,915
X	315	41	356	505	91	596	764	166	930	1,267	332	1,599
Total of classes VIII-X	1,275	186	1,461	1,926	374	2,300	2,876	706	3,582	4,617	1,373	5,990
GRAND TOTAL	14,046	4,293	18,339	17,954	6,318	24,272	25,033	10,408	36,041	34,115	17,514	55,629

Sources: Ministry of Education, Form A of the States concerned till 1960-61. The figures for 1965-66 were estimated in the Secretariat of the Commission.

N.B. Totals do not tally because of rounding.

TABLE AI.6

PROPORTION OF ENROLMENT IN EACH CLASS AT THE SCHOOL STAGE TO TOTAL ENROLMENT

Class	1950-51		1955-56		1960-61			
	Boys	Girls	Boys	Girls	Boys	Girls		
Pro-Primary	0.1	0.2	0.2	0.4	0.3	0.6	0.3	0.6
A	3.9	3.6	2.0	2.5	1.1	1.7	1.0	1.3
B	18.4	25.7	18.2	25.8	15.9	21.4	14.5	19.0
I	21.5	24.1	21.3	24.1	20.6	22.9	20.0	21.8
II	15.3	15.4	14.0	14.6	14.1	14.9	13.8	14.5
III	12.1	11.3	10.9	10.5	11.4	11.3	10.8	11.5
IV	9.1	7.5	8.7	7.3	9.2	8.3	9.6	8.9
V	6.4	4.0	6.5	4.5	7.3	6.0	8.1	7.0
VI	5.0	3.0	5.4	3.4	5.9	4.4	6.4	5.2
VII	3.9	2.1	4.3	2.6	4.8	3.4	5.3	4.0
VIII	3.3	1.5	3.5	1.8	3.8	2.3	4.1	2.8
IX	2.2	0.9	2.8	1.4	3.0	1.6	3.3	1.9
X	1.8	0.7	2.2	1.0	2.5	1.2	2.8	1.5
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source. Ministry of Education, Form A of the States till 1960-61. The figures for 1960-61 were estimated in the Secretariat of the Commission.

In short, we have shown the first year of the Intermediate class as a part of Classes XI and XII in all cases. Where the three-year degree course has been adopted, the second year has been shown in the undergraduate stage. Where the three-year degree course has not been adopted, both the years have been shown under Classes XI and XII, the only exception to this being the city of Bombay for which no separate figures are available.

The Intermediate (Commerce) classes have been regarded as part of general education and the corresponding enrolment has been shown under Classes XI and XII.

The retabulated enrolments on these assumptions have been given in Table AI.7

AI.11. *General Education (Undergraduate Stage)*. In our retabulation, the enrolments in general education at the undergraduate stage include the following:

(i) Enrolments in the second year of the Intermediate classes in all States which have now adopted the three-year degree course.

(ii) Enrolments in the First Degree Courses for Arts and Science.

(iii) Enrolments in the First Degree Courses for Commerce.

AI.12. *General Education (Postgraduate and Research)*. There are no difficulties about the enrolments in general education at the postgraduate stage and research. These have been taken from the publications of the Ministry of Education and are given in Table AI.8 along with the enrolments at undergraduate stage.

AI.13. *Vocational Schools*. The enrolment in vocational schools is of a mixed character. In some courses such as polytechnics, admission is given only to those who have completed the secondary school. In other courses such as teacher-training or in industrial training institutes, admission is given to those who have completed the secondary school as well as to those who have completed the primary school only. In some other courses such as arts and crafts (e.g. tailoring)

the school, it is mostly of those who have not completed the minimum period of schooling and are not yet of the age of 15 years and hence they are not included in the enrolment figures. The enrolment figures are, therefore, not comparable with the enrolment figures of the other countries.

Enrolment in the higher secondary stage (Classes XI and XII) is given in Table A1.10.

A1.10 Enrolment in the higher secondary stage (Classes XI and XII) All the enrolments were taken from the school registers of the schools.

In all the vocational courses, such as engineering and technology, agriculture, animal husbandry, and forestry, enrolment figures are not available. The enrolment figures are, therefore, not comparable with the enrolment figures of the other countries. The enrolment figures are, therefore, not comparable with the enrolment figures of the other countries.

A1.11 The enrolment in the higher secondary stage (Classes XI and XII) The enrolment figures are given in Table A1.11. The enrolment figures are given in Table A1.11. The enrolment figures are given in Table A1.11.

A1.12 Enrolment in the higher secondary stage (Classes XI and XII) The enrolment figures are given in Table A1.12. The enrolment figures are given in Table A1.12. The enrolment figures are given in Table A1.12.

Enrolment corresponding to those at the higher secondary stage (Classes XI and XII)

In the statistics of enrolments in training colleges, the enrolments of students studying for the B.T. or B.E. degree are given in the higher secondary stage enrolment figures. The enrolments in the B.T. or B.E. degree are given in the higher secondary stage enrolment figures. The enrolments in the B.T. or B.E. degree are given in the higher secondary stage enrolment figures.

Similarly the enrolments for Intermediate are given in the higher secondary stage enrolment figures. The enrolments for Intermediate are given in the higher secondary stage enrolment figures. The enrolments for Intermediate are given in the higher secondary stage enrolment figures.

In the same way we have estimated the enrolments in the higher secondary stage enrolment figures. The enrolments in the higher secondary stage enrolment figures are given in Table A1.11. The enrolments in the higher secondary stage enrolment figures are given in Table A1.11.

All the remaining enrolments in the higher secondary stage enrolment figures are given in Table A1.12. The enrolments in the higher secondary stage enrolment figures are given in Table A1.12. The enrolments in the higher secondary stage enrolment figures are given in Table A1.12.

A1.10 The retabulated enrolments on the above assumptions have been shown in Table A1.10.

A1.11 Total Enrolments The total enrolments in the higher secondary stage enrolment figures are given in Table A1.11. The enrolments in the higher secondary stage enrolment figures are given in Table A1.11. The enrolments in the higher secondary stage enrolment figures are given in Table A1.11.

(i) Enrolments in vocational education corresponding to the lower secondary stage (Classes VIII-X) have been taken from the school registers in Table A1.10.

(ii) Enrolments in vocational education corresponding to the higher secondary stage (Classes XI-XII) have been taken from Table A1.9 and A1.10.

(iii) No attempt has been made to include the enrolments in special schools and colleges. These have been reproduced from the publications of the Ministry of Education.

A1.12 Enrolment Statistics published by the Ministry of Education The enrolment statistics published by the Ministry of Education adopt a different system of classification. They start by equating the lowest classes with one another, i.e. Infant 'A' in Assam, Class I in State like Maharashtra with 11-year school system and also Class I in State like Uttar Pradesh with a 10-year school system are all equated together. The enrolment figures are added together. In this method, the main weakness is that classes which are not comparable to each other are added together. For example, Class X of Uttar Pradesh which is pre-matriculation class is added to Class X of Bihar which is pre-matriculation class or Class XI of Delhi which is the higher secondary class is added to Class XI of Maharashtra which is the matriculation class.

The enrolments according to this system have been given in Table A1.12 for purposes of comparison. It will be seen that the totals of enrolments in Tables A1.11 and A1.12 tally. But the enrolments at substages do not tally for reasons already explained.

TABLE A1.7. ENROLMENT IN GENERAL SCHOOL EDUCATION CLASSES XI AND XII (1950-51 TO 1965-66)

Type of Course	1950-51			1955-56			1960-61			1965-66 (Estimated)		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
<i>Classes XI and XII</i>												
General Education . .	121,693	17,193	138,886	223,388	35,655	259,043	384,964	72,353	457,317	638,690	138,320	777,010
Intermediate (Commerce) .	18,554	58	18,612	28,242	242	28,484	33,303	405	33,708	56,745	700	57,445
TOTAL . . .	140,247	17,251	157,498	251,630	35,897	287,527	418,267	72,758	491,025	695,435	139,020	834,455

Source: Ministry of Education, Form A of the States concerned.

TABLE A1.8. ENROLMENT IN GENERAL EDUCATION AT THE UNDERGRADUATE AND POSTGRADUATE STAGES (1950-51 TO 1965-66)

Type of Course	1950-51			1955-56			1960-61			1965-66 (Estimated)		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
1. Undergraduate Courses in Arts & Science . .	153,151	22,029	175,180	248,571	45,961	294,532	313,385	82,483	395,868	549,510	147,480	696,990
2. Undergraduate Courses in Commerce . . .	15,579	104	15,683	27,254	162	27,416	37,919	416	38,335	61,455	800	62,255
TOTAL (UNDERGRADUATE)	168,730	22,133	190,863	275,825	46,123	321,948	351,304	82,899	434,203	610,965	148,280	759,245
3. Postgraduate M.A. & M.Sc. . .	14,401	2,127	16,528	21,293	4,040	25,333	37,541	9,298	46,839	62,350	15,910	78,260
Research . . .	1,051	139	1,190	2,193	371	2,564	3,576	697	4,273	6,450	1,290	7,740
TOTAL (POSTGRADUATE AND RESEARCH) . . .	15,452	2,266	17,718	23,486	4,411	27,897	41,117	9,995	51,112	68,800	17,200	86,000

Source: Ministry of Education, Form A of the States concerned.

TABLE AI.9. ENROLMENT IN VOCATIONAL SCHOOLS(COURSES 1950-51 TO 1965-66)

Type of Course	1950-51			1955-56			1960-61			1965-66 (Estimated)		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
Lower Secondary Stage (Classes VIII - X)												
1. Teacher Training	10,414	3,599	14,013	13,007	5,176	18,183	15,276	6,310	21,586	15,276	6,310	21,586
2. Arts & Crafts etc.	18,185	14,156	32,341	25,553	20,669	52,222	46,854	29,110	75,964	46,854	29,110	75,964
TOTAL	28,599	17,755	46,354	38,560	31,845	70,405	62,130	35,420	97,550	62,130	35,420	97,550
Higher Secondary Stage (Classes XI - XII)												
1. Teacher Training	41,655	14,395	56,050	52,026	20,705	72,731	72,064	25,002	97,066	72,064	25,002	97,066
2. Engineering and Technology	20,811	337	21,148	41,181	214	41,395	37,111	435	37,546	37,111	435	37,546
3. Medicine and Veterinary Science	3,221	1,452	4,673	4,908	2,565	7,473	5,332	6,536	11,868	5,332	6,536	11,868
4. Agriculture and Forestry	1,872	9	1,881	5,332	14	5,346	5,332	74	5,406	5,332	74	5,406
5. Commerce	34,206	3,240	37,446	69,941	1,336	71,277	66,000	1,034	67,034	66,000	1,034	67,034
6. Physical Education*	1,000	300	1,300	1,871	372	2,243	2,629	135	2,764	2,629	135	2,764
7. Library Science							90		90	90		90
8. Co-operation	116		116	1,206		1,206	1,050	15	1,065	1,050	15	1,065
9. Marine Training							1,501		1,501	1,501		1,501
10. Other Subjects				354		354		275	275		275	275
TOTAL	102,881	17,773	120,654	175,279	34,709	210,000	174,000	36,720	210,720	174,000	36,720	210,720
Grand Total	131,466	37,728	169,194	211,279	66,511	277,790	248,030	72,140	320,170	248,030	72,140	320,170

Source: Ministry of Education, Form A.

* We have ignored, for 1960-61, the enrolment in Akhaya because that institution was not an educational institution.

TABLE AL10. ENROLMENT IN PROFESSIONAL COURSES (1950-51 TO 1965-66)

Type of Course	1950-51			1955-56			1960-61			1965-66 (Estimated)		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
<i>Agriculture</i>												
Higher Secondary Stage	1,630	2	1,632	2,359	16	2,375	6,717	74	6,791	11,000	200	11,800
Undergraduate Stage	2,579	20	2,599	3,000	15	3,015	8,671	65	8,692	14,750	150	14,900
Postgraduate & Research	400	2	402	481	6	487	355	10	365	3,280	20	3,300
TOTAL	4,609	24	4,633	5,840	37	5,877	15,699	149	15,848	27,630	370	30,000
<i>Commerce</i>												
Higher Secondary Stage	18,554	58	18,612	28,242	242	28,484	33,303	405	33,708	56,745	700	57,445
Undergraduate Stage	15,579	104	15,683	27,254	162	27,416	37,919	416	38,335	61,455	800	62,255
Postgraduate & Research	2,047	5	2,052	3,000	18	3,018	6,226	43	6,269	9,440	60	9,500
TOTAL	36,180	167	36,347	58,496	422	58,918	77,448	864	78,312	127,640	1,560	129,200
<i>Teacher Training</i>												
Higher Secondary Stage	180	150	330	1,112	890	2,002	17,656	9,632	26,688	25,415	13,685	39,100
Undergraduate Stage	3,399	1,486	4,885	8,500	3,288	11,788	13,500	6,000	19,500	21,300	10,500	32,000
Postgraduate & Research	260	110	370	350	140	490	450	170	620	600	300	900
TOTAL	3,839	1,746	5,585	9,962	4,318	14,280	31,606	15,202	46,808	47,515	24,485	72,000

Source: Ministry of Education, Form A till 1960-61. For 1965-66 figures have been estimated in the Secretariat of the Education Commission.

TABLE AI.10. ENROLMENT IN PROFESSIONAL COURSES (1950-51 TO 1965-66) (Contd.)

Type of Course	1950-51			1955-56			1960-61			1965-66 (Estimated)		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
<i>Engineering and Technology</i>												
Undergraduate Stage	12,968	37	13,005	19,311	34	19,345	46,719	372	47,091	..	..	78,000
Postgraduate and Research	260	3	263	509	4	513	745	2	747	..	..	2,000
TOTAL	13,228	40	13,268	19,820	38	19,858	47,464	374	47,838	..	..	80,000
<i>Law</i>												
Undergraduate Stage	12,936	287	13,223	19,349	331	19,680	25,400	769	26,169	30,662	1,038	31,700
Postgraduate and Research	207	4	211	572	16	588	936	36	972	1,250	50	1,300
TOTAL	13,143	291	13,434	19,921	347	20,268	26,336	805	27,141	31,912	1,088	33,000
<i>Medicine</i>												
Undergraduate Stage	11,930	2,221	14,151	19,721	3,719	23,440	29,264	7,638	36,902	..	..	60,500
Postgraduate and Research	690	110	800	1,364	208	1,572	2,900	600	3,500	..	..	4,000
TOTAL	12,620	2,331	14,951	21,085	3,927	25,012	32,164	8,238	40,402	..	..	65,000
<i>Veterinary Science</i>												
Undergraduate Stage	1,290	6	1,296	3,536	13	3,549	5,328	45	5,373	..	..	6,000
Postgraduate and Research	50	..	50	100	..	100	170	2	172	..	..	250
TOTAL	1,340	6	1,346	3,636	13	3,649	5,498	47	5,545	..	..	6,250

TABLE AI.10. ENROLMENT IN PROFESSIONAL COURSES (1950-51 TO 1965-66) (Contd.)

Type of Course	1950-51			1955-56			1960-61			1965-66 (Estimated)		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
<i>Forestry</i>												
Undergraduate Stage	243	..	243	250	..	250	558	..	558	600	..	600
Postgraduate and Research	70	..	70	70	..	70	125	..	125	200	..	200
TOTAL	313	..	313	320	..	320	683	..	683	800	..	800
<i>Others</i>												
Undergraduate Stage	323	53	376	656	51	707	1,944	410	2,354	..	..	3,250
Postgraduate and Research	..	..	..	40	5	45	145	35	180	..	..	250
TOTAL	323	53	376	696	56	752	2,089	445	2,534	..	..	3,500
<i>Grand Total</i>												
Higher Secondary Stage	20,364	210	20,574	31,713	1,148	32,861	57,676	9,511	67,187	93,760	14,585	108,345
Undergraduate Stage	61,247	4,224	65,471	101,577	7,613	109,190	169,259	15,715	184,974	256,040	33,415	289,455
Postgraduate and Research	3,984	234	4,218	6,486	457	6,943	12,452	898	12,950	20,200	2,000	22,200
TOTAL OF ALL STAGES	85,595	4,668	90,263	139,776	9,218	148,994	238,987	26,124	265,111	370,000	50,000	420,000

Source: Ministry of Education, Form A, except for 1965-66 which have been estimated in the Secretariat of the Commission.

Note: For net enrolments in professional education, the enrolments in I. Com. and B. Com. which are included in the above figures should be excluded.

TABLE AI.11. TOTAL ENROLMENT IN THE EDUCATIONAL SYSTEM (RETABULATED ON THE NEW PATTERN)
(1950-51 TO 1965-66)

(In thousand)

Stage of Education	1950-51			1955-56			1960-61			1965-66 (Estimated)		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
<i>General Education</i>												
1. Pre-Primary . . .	3,377	1,800	5,177	4,598	2,537	7,135	5,381	3,231	8,612	7,146	4,627	11,773
2. Lower Primary (Classes I to IV) . .	10,102	3,549	13,651	12,369	5,011	17,380	17,170	7,826	24,996	24,536	12,554	37,090
3. Higher Primary (Classes V to VII) . .	2,669	559	3,228	3,659	933	4,593	5,587	1,876	7,463	8,962	3,587	12,549
4. Lower Secondary (Classes VIII to X) .	1,275	186	1,461	1,926	374	2,300	2,876	706	3,582	4,617	1,373	5,990
5. Higher Secondary (Classes XI to XII) .	140	17	157	252	36	288	418	73	491	695	139	834
6. Undergraduate . .	169	22	191	276	46	322	351	83	434	611	148	759
7. Postgraduate and Research . . .	15	2	18	23	4	28	41	10	51	69	17	86
<i>Vocational Education</i>												
8. At the Lower Secondary Stage . . .	29	18	46	39	32	70	65	35	100	90	47	137
9. At the Higher Secondary Stage . . .	105	20	125	179	35	214	299	59	358	477	87	564
10. Professional Education (First Degree) . . .	46	4	50	74	7	82	131	15	147	195	33	227
11. Professional Education (Postgraduate & Research) . . .	4	..	4	6	1	7	12	1	13	20	2	22
<i>Special Education</i>												
12. Special Schools . .	132	18	150	182	33	215	162	36	197	185	40	225
13. Special Colleges . .	6	2	7	9	3	12	15	7	22	23	12	35
TOTAL . . .	18,068	6,197	24,265	23,592	9,053	32,645	32,508	13,959	46,467	47,626	22,666	70,292

Note: Totals do not tally because of rounding.

TABLE AI.12. ENROLMENT IN EDUCATION ON THE EXISTING PATTERN (1950-51 TO 1965-66)

Stage of Education	(In thousands)					
	1950-51		1955-56		1960-61	
	Boys	Girls	Boys	Girls	Boys	Girls
General Education						
Pre-Primary	15	13	45	31	97	82
Lower Primary (Classes I-IV) Higher Primary (Classes V-VII)	12,294	4,961	15,706	7,058	21,002	10,380
Lower Secondary (Classes VIII-X)	3,338	829	4,308	1,229	6,299	2,259
Higher Secondary (Classes XI-XII)	1,551	259	2,204	474	3,250	841
Pre-University/Intermediate@	230	33	294	66	447	92
Undergraduate	195	26	342	55	381	77
Postgraduate & Research	75	12	126	25	236	64
Vocational Education (School Standard)	15	2	23	4	41	10
Professional Education (College Standard)	149	41	214	66	339	86
Special Education (School Standard)	86	5	140	9	239	26
Special Education (College Standard)	132	18	192	33	162	36
TOTAL	18,086	*6,201	23,592	9,053	**32,508	**13,959
		*24,287		32,645		**46,467
					47,626	22,666
						70,292

@ Includes enrolment in Classes XI and XII in U.P.

* Includes 17,965 boys and 3,595 girls in Akharas (Vocational education school standard). These have been excluded in the revised consolidation.

** Excludes 6,197 boys and 852 girls in NEFA and includes 2,842 boys and 1,485 girls in unrecognized institutions in Nagaland whose class-wise distribution is not available.

Note: Totals do not tally because of rounding.

RESOLUTION OF THE GOVERNMENT OF INDIA SETTING UP THE EDUCATION COMMISSION*

AII.01. The Government of India, ever since the attainment of independence, have given considerable attention to the development of a national system of education rooted in the basic values and the cherished traditions of the Indian nation and suited to the needs and aspirations of a modern society. While some advances have been made in these directions, the educational system has not generally evolved in accordance with the needs of the times, and a wide and distressing gulf continues to persist between thought and action in several sectors of this crucial field of national activity. In view of the important role of education in the economic and social development of the country, in the building of a truly democratic society, in the promotion of national integration and unity, and above all, for the transformation of the individual in the endless pursuit of excellence and perfection, it is now considered imperative to survey and examine the entire field of education in order to realize within the shortest possible period a well-balanced, integrated and adequate system of national education capable of making a powerful contribution to all spheres of national life.

AII.02. The attainment of independence ushered in a new era of national development founded upon: the adoption of a secular democracy, not only as a form of government but also as a way of life; the determination to eliminate the poverty of the people and to ensure a reasonable standard of living for all, through modernization of agriculture and rapid development of industry; the adoption of modern science and technology and their harmonizing with traditional spiritual values; the acceptance of a socialistic pattern of society which will secure equitable distribution of wealth and equality of opportunity for all in education, employment and cultural advancement. Greater emphasis came to be placed on educational development because of the realization that education, especially in science and technology, is the most powerful instrument of social transformation and economic progress and that the attempt to create a new social order based on freedom, equality and justice can only succeed if the traditional educational system was revolutionized, both in content and extent.

AII.03. Quantitatively, education at all levels has shown a phenomenal development in the post-Independence period. In spite of this expansion, however, there is widespread dissatisfaction about several aspects of educational development. For instance, it has not yet been possible to provide free and universal education for all children up to 14 years of age. The problem of mass illiteracy continues to be immense. It has not been possible to raise standards adequately at the secondary and university stages. The diversification of curricula in secondary and higher education has not kept pace with the times so that the problem of educated unemployment has been intensified on the one hand while, on the other, there is an equally acute shortage of trained manpower in several sectors. The remuneration and service conditions of teachers leave a great deal to be desired; and several important academic problems are still matters of intense controversies. In short, qualitative improvements in education have not kept pace with quantitative expansion, and national policies and programmes concerning the quality of education, even when these were well-conceived and generally agreed to, could not be implemented satisfactorily.

AII.04. The Government of India are convinced that education is the key to national prosperity and welfare and that no investment is likely to yield greater returns than investment in human resources of which the most important component is education. Government have also decided to mobilize all the resources of science and technology which can only be done on the foundation of good and progressive education and, to that end, to increase considerably their total investment in the development of education and scientific research. The nation must be prepared to pay for quality in education, and from the value attached to education by all sectors of the people it is clear that they will do so willingly.

AII.05. It is desirable to survey the entire field of educational development as the various parts of the educational system strongly interact with and influence one another. It is not possible to

*N. F.41 3(3)64-E.I. Ministry of Education, Government of India, New Delhi, the 14th of July 1964 as finally modified.

have progressive and strong universities without efficient secondary schools and the quality of these schools is determined by the functioning of elementary schools. What is needed, therefore, is a synoptic survey and an imaginative look at education considered as a whole and not fragmented into parts and stages. In the past, several commissions and committees have examined limited sectors and specific aspects of education. It is now proposed to have a comprehensive review of the entire educational system.

AII.06. While the planning of education for India must necessarily emanate from Indian experience and conditions, Government of India are of the opinion that it would be advantageous to draw upon the experience and thinking of educationists and scientists from other parts of the world in the common enterprise of seeking for the right type of education which is the quest of all mankind, specially at this time when the world is becoming closely knit together in so many ways. It has, therefore, been decided to associate with the Commission, either as members or as consultants, some eminent scientists and educationists from other countries. The United Nations Educational, Scientific and Cultural Organization has provided three members for the Commission, viz., Mr. Jean Thomas, Inspector General of Education, France, and formerly Assistant Director General of UNESCO, Prof. Shumovsky, Director, Methodological Division, Ministry of Higher and Special Secondary Education, RSFSR, Moscow, and Professor of Physics, Moscow University, and Prof. Sadatoshi Ihara, Professor of the First Faculty of Science and Technology, Waseda University, Tokyo, who have since joined the Commission. It is expected that the collaboration of some eminent scientists and educationists, as consultants, with the work of the Commission, will also be forthcoming. Negotiations are in progress with some more specialists and additions of names of foreign consultants will be notified from time to time. In addition, the Commission has been authorized to invite from time to time such other consultants in India in relation to any aspect of its enquiry as it may consider necessary.

AII.07. For the purposes outlined in the foregoing paragraphs, Government of India have decided to set up an Education Commission consisting of the following members:

Chairman

1. Prof. D. S. Kothari, Chairman, University Grants Commission, New Delhi.

Members

2. Shri A. R. Dawood, former Director, Extension Programmes for Secondary Education, New Delhi.
3. Mr. H. L. Elvin, Director, Institute of Education, University of London, London.
4. Shri R. A. Gopalaswami, Director, Institute of Applied Manpower Research, New Delhi.
5. Dr. V. S. Jha, former Director of the Commonwealth Education Liaison Unit in London.
6. Shri P. N. Kirpal, Educational Adviser to the Government of India, New Delhi.
7. Prof. M. V. Mathur, Professor of Economics and Public Administration, University of Rajasthan, Jaipur.
8. Dr. B. P. Pal, Director, Indian Agricultural Research Institute, New Delhi.
9. Kumari S. Panandikar, Head of the Department of Education, Karnatak University Dharwar.
10. Prof. Roger Revelle, Dean of Research, University of California, USA.
11. Dr. K. G. Saiyidain, former Educational Adviser to the Government of India, New Delhi.
12. Dr. T. Sen, Rector, Jadavpur University, Calcutta.

13. Mr. Jean Thomas, Inspector General of Education, France, and formerly Assistant Director-General of UNESCO.
14. Prof. S. A. Shumovsky, Director, Methodological Division, Ministry of Higher and Special Secondary Education, RSFSR, Moscow, and Professor of Physics, Moscow University.
15. Prof. Sadatoshi Ihara, Professor of the First Faculty of Science and Technology, Waseda University, Tokyo.

Member-Secretary

16. Shri J. P. Naik, Head of the Department of Educational Planning, Administration and Finance, Gokhale Institute of Politics and Economics, Poona.

Associate Secretary

17. Mr. J. F. McDougall, Assistant Director, Department of School and Higher Education, UNESCO, Paris.

AII.08. The Commission will advise Government on the national pattern of education and on the general principles and policies for the development of education at all stages and in all its aspects. It need not, however, examine the problems of medical or legal education, but such aspects of these problems as are necessary for its comprehensive enquiry may be looked into.

AII.09. The Commission will submit its final report as early as possible and not later than the 31st March, 1966. Where immediate implementation of certain programmes is necessary the Commission may also submit, from time to time, interim reports dealing with limited sectors on problems of education. Government are anxious that the implementation of agreed recommendations about specific matters of importance shall on no account be held up until the completion of the Commission's work. On the other hand its expert advice and guidance should be continuously available to those charged with the responsibility for implementing educational programmes and policies.

Ordered that a copy of the Resolution be communicated to all State Governments and Administrations of Union Territories and to all Ministries of the Government of India.

Ordered also that the Resolution be published in the Gazette of India for information.

PREM KIRPAL
Secretary to the Government of India

APPENDIX III

AIII.01 CONSULTANTS TO THE EDUCATION COMMISSION

1. Dr. James E. Allen, Jr., Commissioner, State Education Department, and President, University of the State of New York, New York, USA.
2. Dr. C.E. Beeby, Visiting Professor, Centre for Studies in Education and Development, Graduate School of Education, Harvard University, Cambridge, Massachusetts, USA.
3. Prof. P.M.S. Blackett, President of the Royal Society, UK, and Professor of Physics, Imperial College of Science and Technology, University of London, London.
4. Recteur J.J. Capelle, Professor, University of Nancy, and former Director-General of Education in France, Paris.
5. Sir Christopher Cox, Educational Adviser, Ministry of Overseas Development, UK, and Fellow, New College, Oxford.
6. Dr. Philip H. Coombs, Director, UNESCO International Institute for Educational Planning, Paris.
7. Prof. Andre Diniere, Centre for Studies in Education and Development, Graduate School of Education, Harvard University, Cambridge, Massachusetts, USA.
8. Prof. S. Dedjjer, Institute of Sociology, University of Lund, Sweden.
9. Dr. Nicholas DeWitt, Director, International Survey of Educational Development and Planning, Indiana University, Bloomington, Indiana, USA.
10. Dr. John Guy Fowlkes, School of Education, University of Wisconsin, Madison, USA.
11. Sir Willis Jackson, Head of the Department and Professor of Electrical Engineering, Imperial College of Science & Technology, University of London, London.
12. Dr. J. Paul Leonard, Professor of Education, Columbia University Teachers' College, and Chief of Party, Columbia University Team in India, New Delhi.
13. Dr. Gordon N. Mackenzie, Professor of Education, Teachers' College, Columbia University, New York, USA.
14. Professor C. A. Moser, Director, Unit for Economic and Statistical Studies on Higher Education, London School of Economics and Political Science, London.
15. Prof. S. Okita, Executive Director, Japan Economic Research Centre, Tokyo, and Special Adviser to the Minister of Economic Planning Agency, Government of Japan.
16. Professor A.R. Prest, Professor of Economics and Public Finance, University of Manchester Manchester, England.
17. Lord Robbins, Professor Emeritus, London School of Economics, and Chairman of *Financial Times*, London. Recently Chairman of the Committee on Higher Education, UK.
18. Professor Edward A. Shils, Professor of Sociology and Social Thought in the Committee on Social Thought, University of Chicago, USA, and Fellow of King's College, Cambridge, UK.
19. Dr. Frederick Seitz, President, National Academy of Sciences, Washington, USA.
20. Professor W.C. Smith, Professor of World Religions and Director, Centre for the Study of World Religions, Harvard University, Cambridge, Massachusetts, USA.

APPENDIX IV

TASK FORCES AND WORKING GROUPS

AIV.01 Task Force on Adult Education

1. Dr. V. S. Jha, Member, Education Commission, New Delhi. *Convener*
2. Shri Abdul Qadir, Director-General of Employment & Training, Ministry of Labour & Employment, New Delhi.
3. Shri G. K. Chandiramani, Additional Secretary, Ministry of Education, New Delhi.
4. Shri A. R. Deshpande, Adviser (Social Education), Ministry of Education, New Delhi.
5. Shrimati Durgabai Deshmukh, Vice-Chancellor's Residence, Delhi University, Delhi.
6. Mrs. Welthy Fisher, Literacy House, Kanpur Road, Lucknow.
7. Shri K. L. Joshi, Secretary, University Grants Commission, New Delhi.
8. Shri D. R. Kalia, Director, Delhi Public Library, Delhi.
9. Dr. T. A. Koshy, Director, National Fundamental Education Centre, 38-A, Friends Colony (East), Mathura Road, New Delhi.
10. Mr. J. F. McDougall, Associate Secretary, Education Commission, New Delhi.
11. Dr. M. S. Mehta, Vice-Chancellor, Rajasthan University, Jaipur.
12. Mrs. A. R. Moore, Regional Adviser on Health Education, World Health Organization, WHO House, Ring Road, New Delhi.
13. Shri J. P. Naik, Member-Secretary, Education Commission, New Delhi.
14. Dr. M. S. Randhawa, Special Secretary, Ministry of Food & Agriculture (Department of Agriculture), New Delhi.
15. Dr. K. G. Saiyidain, Member, Education Commission, New Delhi.
16. Dr. Hans Simons, Ford Foundation, 32, Feroze Shah Road, New Delhi.
17. Shri Sohan Singh, Asia Foundation, 29, Rajpur Road, Delhi.
18. Dr. S. M. S. Chari, Deputy Educational Adviser, Education Commission, New Delhi. *Secretary*

Sub-Group on Literacy Education

MEMBERS

1. Mrs. Durgabai Deshmukh, Vice-Chancellor's Residence, University of Delhi, Delhi. *Convener*
2. Shri A. R. Deshpande, Adviser (Social Education), Ministry of Education, New Delhi.
3. Dr. T. A. Koshy, Director, National Fundamental Education Centre, New Delhi.
4. Shri Mustaq Ahmed, Director, Literacy House, Lucknow.
5. Shri H. P. Saxena, Assistant Director, National Fundamental Education Centre, New Delhi.

Sub-Group on Role of Universities and Institutions of Higher Learning in Adult Education

MEMBERS

1. Shri Sohan Singh, Asia Foundation, New Delhi. *Convener*
2. Shri Bashiruddin, 33-A, Kasturba Gandhi Marg, Allahabad.
3. Dr. Nagendra, Chairman, University Extension Lectures Board, University of Delhi, Delhi.
4. Dr. K. G. Saiyidain, Member, Education Commission, New Delhi.
5. Dr. Hans Simons, Ford Foundation, New Delhi.
6. Shri Uma Shankar, Director, Adult Education Department, Rajasthan University, Jaipur.

Sub-Group on Education of Workers

MEMBERS

1. Dr. T. A. Koshy, Director, National Fundamental Education Centre, Friends Colony, New Delhi. *Convener*
2. Shri Abdul Qadir, Director-General, Employment and Training, Ministry of Labour and Employment, New Delhi.
3. Shri N. Bhadriah, President, Mysore State Adult Education Council, Mysore.
4. Shri L. S. Chandrakant, Joint Educational Adviser, Ministry of Education, New Delhi.
5. Shri Chenstal Rao, Secretary, Federation of Indian Chambers of Commerce and Industry, New Delhi.
6. Shri S. C. Datta, Secretary, Indian Adult Education Association, Indraprastha Estate, New Delhi.
7. Shri M. C. Nanavatty, Director (Social Education), Ministry of Food and Agriculture, New Delhi.
8. Shri Annasaheb Sahasrabudhhe, Chairman, Rural Industries Planning, Planning Commission, New Delhi.
9. Dr. R. K. Singh, Director, Rural Institute, Bichpuri (Agra), U.P.

Sub-Group on Role of Cultural Institutions in Adult Education

MEMBERS

1. Shri D. R. Kalia, Director, Delhi Public Library, Delhi. *Convener*
2. Shrimati Kamladevi Chattopadhyay, Chairman, All-India Handicrafts Board, Wellington Crescent, New Delhi.
3. Shri J. C. Mathur, Joint Secretary, Ministry of Food and Agriculture, New Delhi.
4. Dr. Grace Morley, Director, National Museum, New Delhi.
5. Dr. Mulk Raj Anand, Panjab University, Chandigarh.
6. Dr. M. S. Randhawa, Special Secretary, Ministry of Food and Agriculture, New Delhi.

AIV.02. Task Force on Agriculture Education

1. Dr. B. P. Pal, Director-General and Vice-President, I.C.A.R. and Additional Secretary, Ministry of Food and Agriculture, New Delhi. *Convener*
2. Dr. Amir Ali, Director, Rural Institute, Jamia Millia, Jamia Nagar, New Delhi.
3. Dr. Anant Rao, Dean, U.P. Agricultural University, Pant Nagar.
4. Dr. Chintamani Singh, Dean, Veterinary College, Punjab Agricultural University, Hissar.
5. Dr. R. W. Cummings, Field Director, Rockefeller Foundation Programme in India, 17, Kautilya Marg, Chanakyapuri, New Delhi-21.
6. Prof. V. M. Dandekar, Centre for Advanced Study in Agricultural Economics, Gokhale Institute of Politics and Economics, Poona.
7. Dr. K. C. Kanungo, Head of the Division of Agricultural Economics, Indian Agricultural Research Institute, New Delhi.
8. Dr. A. B. Joshi, Dean and Deputy Director (Education), Indian Agricultural Research Institute, New Delhi.
9. Managing Director, Banana and Fruit Development Corporation, 7, 1st Main Road, C.I.T. Colony, Madras.
10. Mr. J. F. McDougall, Associate Secretary, Education Commission, New Delhi.
11. Dr. S. N. Mehrotra, Deputy Secretary, Education Department, Government of Uttar Pradesh, Lucknow.
12. Dr. S. K. Mukherji, Deputy Agricultural Commissioner, Indian Council of Agricultural Research, Krishi Bhavan, New Delhi.
13. Shri J. P. Naik, Member-Secretary, Education Commission, New Delhi.
14. Dr. K. C. Naik, Vice-Chancellor, University of Agricultural Science, 9-XI Main, 16th Cross, Malleswaram, Bangalore-3.
15. Dr. N. K. Panikar, Director, Indian Programme, Indian Ocean Expedition, C.S.I.R., New Delhi.
16. Shri C. S. Ranganathan, Fertilizer Association of India, New Delhi.
17. Dr. S. C. Verma, Field Adviser (Agriculture), N.C.E.R.T., New Delhi.
18. Shri S. Ramanujam, Assistant Educational Adviser, Education Commission, New Delhi. *Secretary*

AIV.03. Task Force on Educational Administration

1. Shri Prem Kirpal, Secretary, Ministry of Education and Member, Education Commission, New Delhi. *Convener*
2. Shri A. C. Deve Gowda, Director, Directorate of Extension Programmes for Secondary Education (N.C.E.R.T.), 7, Lancer Road, Timarpur, Delhi-6.
3. Dr. V. Jagannadham, Professor of Social Administration, Indian Institute of Public Administration, Indraprastha Estate, New Delhi.
4. Prof. M. V. Mathur, Member, Education Commission, New Delhi.
5. Dr. S. Misra, Director of Public Instruction, Orissa (now Vice-Chancellor, Utkal University), Cuttack

6. Dr. S. N. Mukherjee, Head of the Department of Educational Administration, (N.C.E.R.T.), B-2/6A, Model Town, Delhi-9.
7. Shri J. P. Naik, Member-Secretary, Education Commission, New Delhi.
8. Shri H. M. Patel, Chairman, Charotar Vidya Mandal, Vallabh Vidyanagar, via Anand (Gujarat).
9. Dr. D. M. Sen, Education Secretary, West Bengal, (now Vice-Chancellor, Burdwan University), Calcutta.
10. Shri J. D. Sharma, Director of Public Instruction, Punjab, Chandigarh.
11. Shri V. D. Sharma, Education Secretary, Rajasthan, Jaipur.
12. Dr. Rudra Dutt Singh, Head of the Research Project on Panchayati Raj Institutions, Indian Institute of Public Administration, Indraprastha Estate, New Delhi.
13. Miss S. Rajan, Assistant Educational Adviser, Education Commission, New Delhi.
Secretary

AIV.04. Task Force on Educational Finance

1. Prof. M. V. Mathur, Member, Education Commission, New Delhi. *Convener*
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8. Dr. Atmanand Misra, Director of Public Instruction, Madhya Pradesh, Bhopal.
9. Dr. Sadashiv Misra, Director of Public Instruction, (now Vice-Chancellor, Utkal University), Cuttack, Orissa.
10. Shri J. P. Naik, Member-Secretary, Education Commission, New Delhi.
11. Dr. K. A. Naqvi, Delhi School of Economics, University of Delhi, Delhi.
12. Dr. Pritam Singh, Director, National Council of Applied Economic Research, New Delhi.
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AIV.05. Task Force on Higher Education

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6. Shri R. Prasad, Director, Manpower, Ministry of Home Affairs, (now Development Commissioner, Bihar), New Delhi.
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AIV.08. Task Force on Professional, Vocational and Technical Education

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AIV.09. Task Force on Science Education

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3. Prof. B. D. Jain, Professor of Chemistry, Delhi University, Delhi.
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AIV.10. Task Force on School Education

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AIV.13. Working Group on Educational Buildings

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INDEX

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References are given by para number, table number or figure number, and not by page number. Every entry or sub-entry under each main heading is followed by the chapter and para number (separated from each other by a point). If there is a further reference to a section within the para, the section number is given in parentheses after the para number. The table numbers are also made up of the chapter number followed by the serial number of the table, separated by a point. Paragraph and table numbers for the Supplementary Notes and Supplemental Notes are prefixed by the code letter 'S', and the number of the Note in which they occur. In the case of the Appendices, the code letter 'A' and the number of the Appendix are prefixed. Figures, including charts and graphs, and footnotes have been numbered serially throughout the Report.

Cross-references within the index in the form of see and see also entries are given to help the reader to locate allied information given elsewhere in the index.

Government departments are listed under the name of the country or State (in the case of India) of which they are departments. Institutions have been generally listed under their own names, often by initials, though they may be semi-governmental institutions.

Apart from the generally recognized abbreviations, the following special abbreviations have been used:

agric.	agriculture	dev.	development
a-v	audio-visual	educ.	education (al)

exp.	expenditure	no.	number
inst.	institute	postgrad.	postgraduate
instr.	instruction	re	regarding
irt	in relation to	recomm.	recomunendation
Min.	Ministry	thro'	through
nat.	national	undergrad.	undergraduate

~ This symbol stands for the main heading under which the entry or sub-entry occurs.

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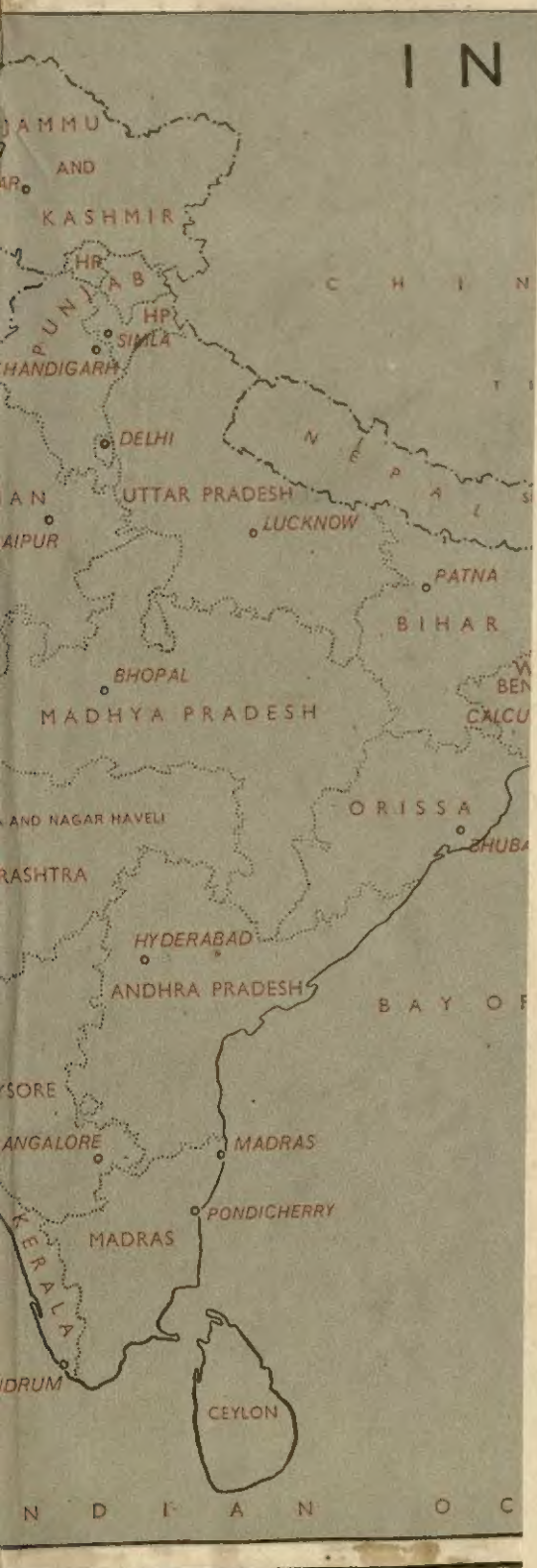
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